THE INDEPENDENT GUIDE TO PERSONAL COMPUTING DECEMBER 20, 1994 VOL. 13 NO. 22 U.S. $3.95 / CAN. $4.95 / U.K. £2.95

EDITORIAL LIBRARY

PC MAGAZINE NETWORK EDITION

LAN Server Advanced & Windows NT Server:

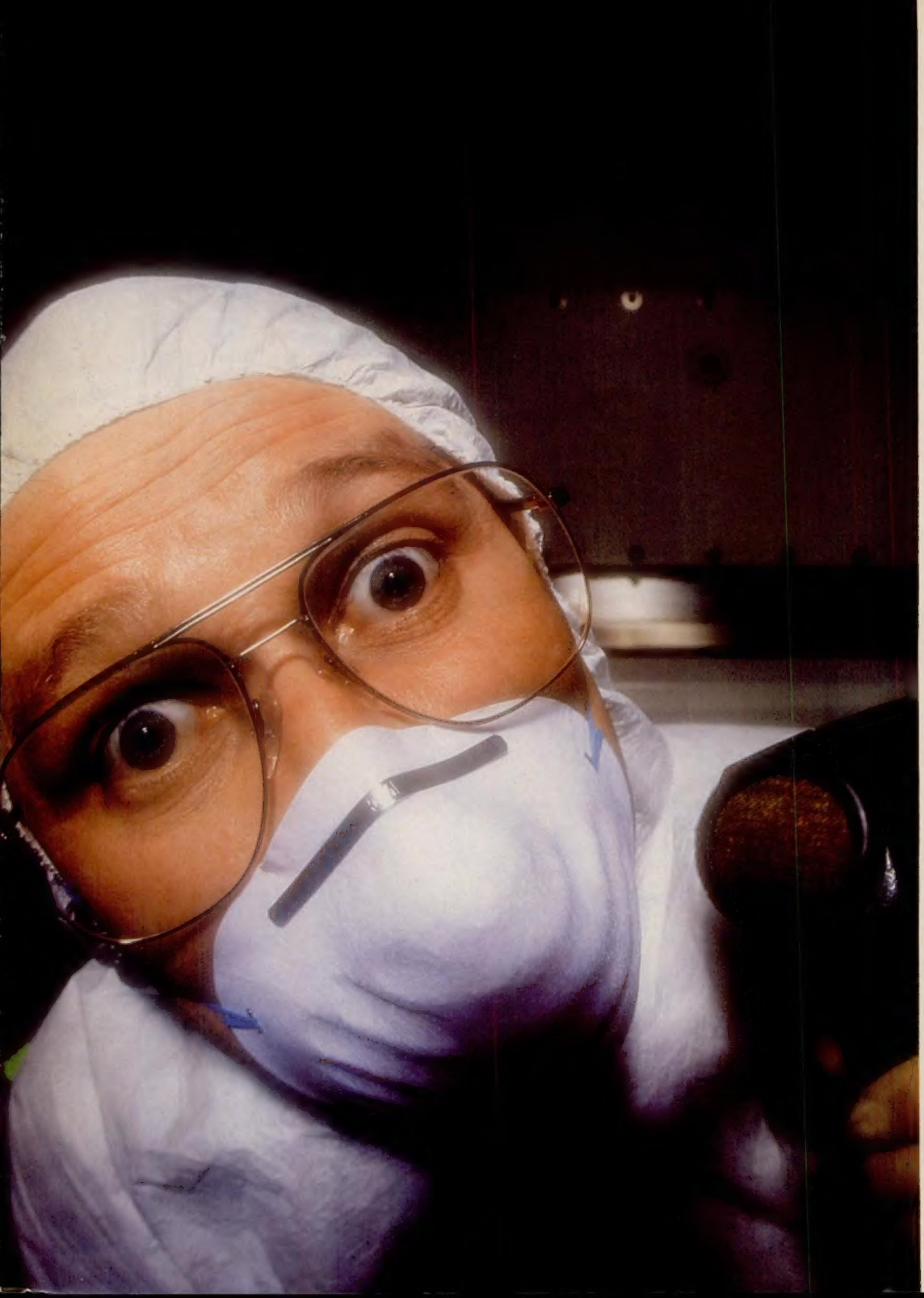
NetWare's Not the Only Game in Town

What's 32-Bit and Here Today? OS/2 Warp 3 and Windows NT 3.5

HAL, Move Over: 10 Products Bring Voice Recognition To Your Computer

11th ANNUAL AWARDS FOR Technical Excellence

L.C.S. OBLITERATES BACTERIA AND PATHOGENIC SPORES.



WHEN YOU BUY A COMPUTER, DON'T MAKE YOUR CHILDREN PAY FOR THE MONITOR.

When you choose the ideal system for your home, don't overlook the most obvious component: The monitor. Computer companies will frequently include a low-quality monitor, which makes a complete system easier to buy. But a lot harder to live with.

Nokia is Finland's largest multinational company, and the leading brand of monitors in Europe.

If you chose your monitor as carefully as the rest of your system, it would probably look like the Nokia 17" 447L multimedia monitor. With a .28 mm dot pitch flat square tube, maximum resolution of 1024 x 768 at a refresh rate of 75 Hz, the 447L is the caliber of display usually enjoyed by graphics professionals. In fact, Nokias have been named a

*When used together with an appropriate graphics card. 17" CRT yields a diagonal picture size of 15.75". Manufactured and designed in Finland in an ISO 9001 approved environment.
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PC Magazine Editors' Choice and an Experts' Pick in *Windows Sources*. So the 447L is particularly suitable for the graphics-rich programs families tend to run. The 447L also features front panel solid-state screen adjustments and stereo powered speakers under the bezel—ideal for multimedia software. Which brings us to the most important consideration.

Children now spend long hours with their young eyes just inches away from monitor screens. Here the 447L shows its real value. Its emissions control has earned Sweden's MPRII certification—one of the strictest standards in the world. Its ergonomics reduce eyestrain and fatigue, and demonstrate real user-sensitivity.*

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Not only is the 447L friendlier to users, the suggested retail price of $699** is very kind to family budgets.

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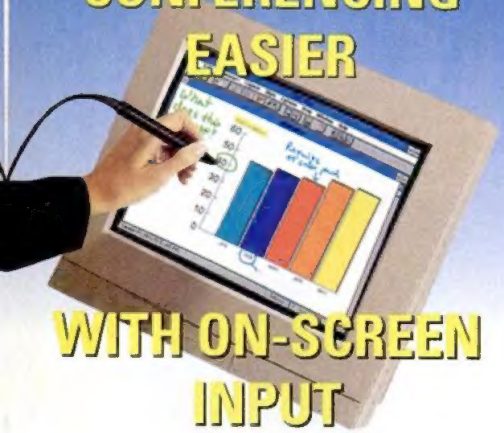

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Inside

Our industry has garnered a reputation for burning the midnight oil. Well, we'd sure like to know the total gallons burned during the creation of this year's Technical Excellence Award winners. Our finalists push the envelope of innovation. They stand out in their respective categories because the technologies they pioneer are destined to change the course of the industry.

Of course it's not easy to get *PC Magazine* staffers and contributors to agree on the essence of what is excellent. That's why we started debating the merits of potential winners in late summer. And we kept on debating right up until our cutoff date, the waning hours of September 30. Our tools for managing this "mother of all discussions" included a Lotus Notes database (which grew to be about 1,500 messages strong) and videoconferencing. Tom Mace, the associate editor for this annual rite of passage, also got the editors to pause long enough to reflect on the past 20 years of personal computing and speculate on the next 20 years to come.

***PC Magazine*'s technically excellent adventure.**

Time does not stand still, even for excellence. Since we closed the ballots, some show-stopping products have shipped. Take IBM's OS/2 Warp, Version 3. Executive editor Rick Ayre and project leader Amarendra Singh take a good look at OS/2 Warp and Microsoft's newest OS, Windows NT Workstation 3.5. "OS/2 Warp 3 and Windows NT 3.5: The Future's Here Today" reflects the results of their relentless testing.

Elsewhere in this issue, "Talk Show" looks at the maturing field of voice recognition, with its own set of innovative, cutting-edge products.

In the end, it may be the home PC that's at the root of the most extraordinary innovations yet to come. In "What Goes into a Great Home PC," we look at 24 PCs designed to make recreational computing a rich, mind-expanding experience.

Wherever innovation is, that's where you'll find us—burning the midnight oil with the best of them.—*Robin Raskin*

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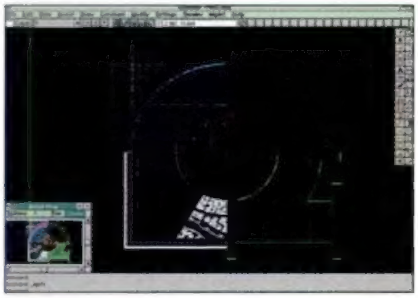

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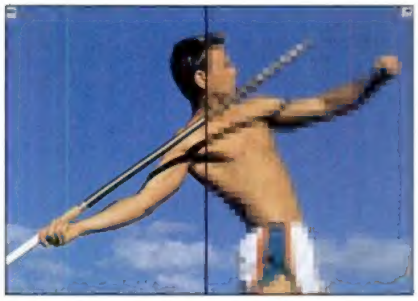

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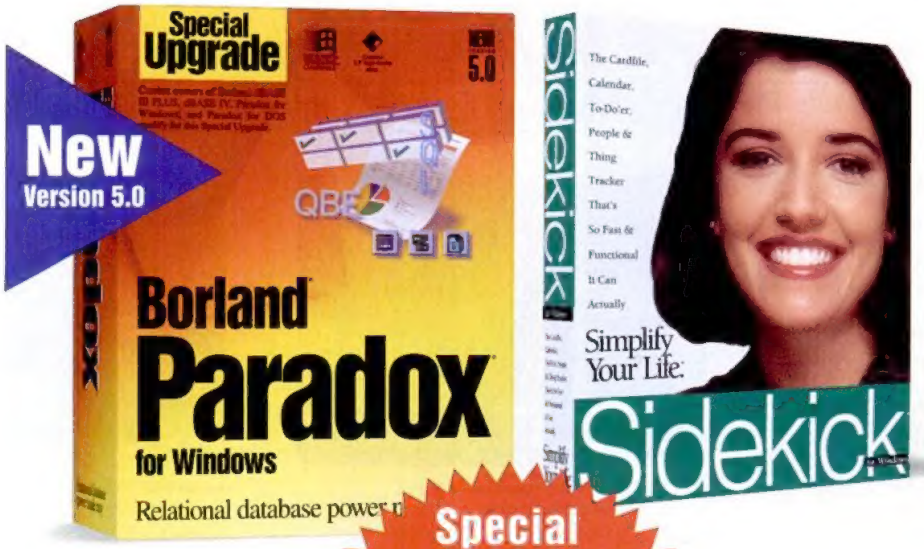

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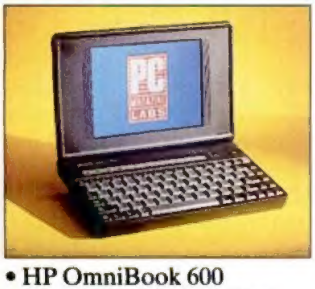

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The 11th ANNUAL AWARDS *for* TECHNICAL EXCELLENCE

BY MICHAEL M. MILLER

As we look back on 20 years of personal computing, it is clear that the pace of technical innovation has never been faster. The winners of our Annual Awards for Technical Excellence—selected by *PC Magazine*'s editorial staff after weeks of heated debate—prove the point. We also celebrate personal computing's twentieth birthday with a fond look back at the past two decades and a long gaze in the crystal ball to see where we will be by the end of the century.....**111**

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Cover photography by Thom O'Connor

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What Goes into A Great Home PC?

BY BILL HOWARD Just in time for the holiday buying season, *PC Magazine* reviews 23 multimedia-equipped PCs targeted toward the burgeoning home marketplace. We complement our usual gamut of benchmark tests with a look at the qualities that set these systems apart from the crowd, including impressive software bundles, uncomplicated setup, and telephony or even television features **154**

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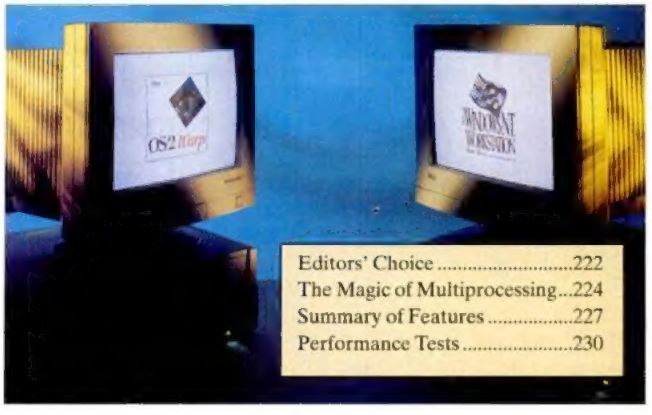

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The Creative Labs Aeroduet gives input devices a whole new look (page 392).

The detail of EPSON's 2400 dpi, scanner really stands

Actual 30-bit scan

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Dual Connectivity	yes	no	no	no

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Jon Peddie Associates, Sept. 20, 1994, p.753

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James Karney, PC Magazine, October 25, 1994

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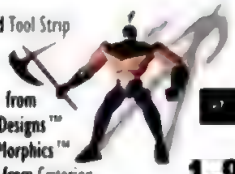

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WinBench 4.0 scores based on 4 MB PCI boards using a Pentium PE-90, 16 MB RAM, 256KB cache
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Notes:
(1) Requires 4 MB of VRAM
(2) Only available with MGA Impression Plus

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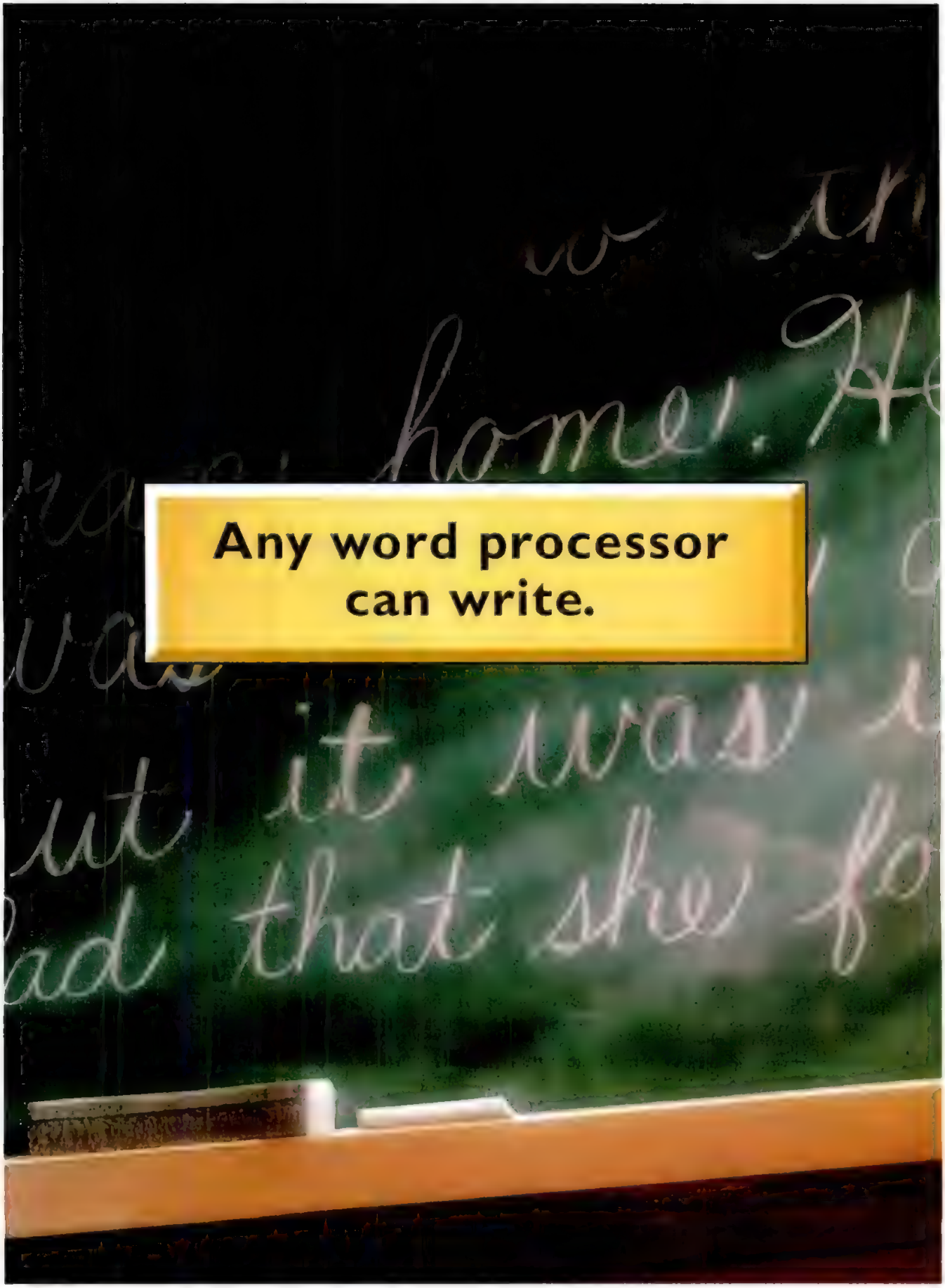

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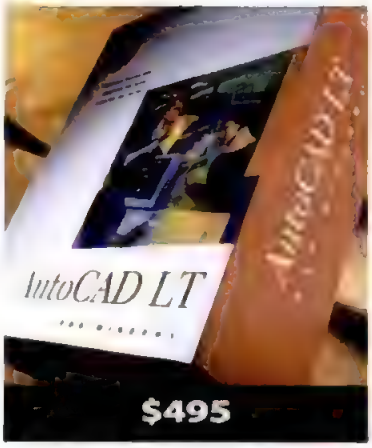

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Letters

STILL ALIVE AND KICKING

In his column "DOS Is Alive, and, Well. . ." (September 13, 1994), John C. Dvorak misses the point. DOS is alive and well not only because it works, but because it works better and faster than GUIs do, and it takes less memory to provide equivalent results. GUIs meet the need of computer vendors to market the latest machines with greater memory, faster CPUs, and larger hard disks. But from the user's standpoint, the GUI concept is a giant step backwards that requires more resources to provide results equivalent to DOS.

Roger Southwick
Silver City, New Mexico

All hail the command line! I heartily agree with Dvorak's praise of the command line. The good old DOS command line is so much easier to use than the Windows File Manager. And in true operating systems like OS/2 and Unix the command line gives you access to the whole system in one place. Powerful interfaces like this will never die!

Robert Sardelli
via the Internet

Having recently taken Windows off my PC at home because it sat unused for three years, I am thankful for Dvorak's enlightening column; it gave me some reassurance that perhaps I'm not as out-of-date as I thought. I've been afraid that DOS might indeed die just because everyone was saying it would.

Richard Kessler
via PC MagNet

As someone who's used both DOS and GUI systems, I think that anyone who still praises DOS must be a glutton for punishment—including Dvorak.

Kim Lathbury
Charleston, South Carolina

Dvorak missed the point entirely. Most DOS users seldom see the command line; instead, they use a variation of a menu program to manage their applications. The reason DOS is still prospering has to do more with the fact that most users—in particular, home users and smaller companies—cannot afford to run out and replace hardware every time some new gadget or system upgrade reaches the market.

Gary White
Overland Park, Kansas

DOS Is Alive, and, Well...

DOS is alive and well because it works better and faster.

While I agree with most of the sentiments Dvorak expressed, I have a problem with the words *masculine* and *girlish* as used to describe the command-line and GUI environments, respectively. Personally, I have been a programmer for over six years, and I've always preferred a command line interface. Though Dvorak's remarks were intended to be humorous, they perpetuate the myth that women can't be "real programmers." Dvorak could have used terms that were not gender-specific, giving his point more punch while retaining the humor.

Catherine Costas
via the Internet

Sure, DOS is alive. Breathing is another question. Most users are uncomfortable with computers and basically happy that the hardware and software continue to work when they turn on their machines. Once they've achieved success, they're willing to sacrifice function and ease of use for the known quantity of reliability.

Joe Warren
via the Internet

Cheers to Dvorak for having the calm voice above the storm of Windows groupies! Those of us who still prefer to think on the job relish the command line interface as we would any intimate relationship. There's a small group of DOS enthusiasts with whom I associate whose mottos are "In DOS We Trust" and "Just Say No to Windows."

Joe DeMeyer
via the Internet

LA CRÈME DE LA CRÈME

Thanks for a most exhaustive overview of the best CD-ROMs available today ("The Top 100 CD-ROMs," September 13, 1994). With regard to future purchases of CD-ROMs, this article provides an invaluable reference.

Tim Gamble
Kemah, Texas

All I can say is this: Your CD-ROM roundup was a comprehensive treatise. You have my humble congratulations on a fantastic article.

Hugh Upton
via PC MagNet

Your articles on CD-ROMs only strengthened the argument for parents to consider purchasing a home computer. Thanks to edutainment CD-ROMs, the computer is no longer just an expensive video game system, it's a great learning tool that I wish I'd had when I was a child. Fortunately, it's never too late—one never stops learning.

James Hollis
Enfield, New Hampshire

As underscored by your CD-ROM roundup, the CD-ROM is quickly becoming the software medium of choice. But the increasing prevalence of CDs raises the important issue of CD-ROM recycling, an issue that assumes heightened importance when you consider the grow-

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ing number of subscription CD-ROMs. This practice prompts many offices to discard as many as 40 CD-ROMs per month, which seems both wasteful and environmentally unsound. I've heard that CD-ROMs make great infant mobiles, but aside from that limited use, they're just piling up.

Dickson Leung
via PC MagNet

On your recommendation, I acquired Microsoft's Multimedia Schubert: The Trout Quintet. And though I certainly like the comprehensive program, there's one major feature that's sorely lacking: the score. Musicians and nonmusicians alike often wish to read the musical score while listening. This feature would not only enhance users' enjoyment of the product but would also increase the CD-ROM's educational value.

Real Morel
via PC MagNet

CD-ROMS ARE NOT TO BLAME

John C. Dvorak's sidebar "Bad CD-ROMs: Dvorak's Duds" (September 13, 1994) has indeed strengthened my respect for the technical abilities of Macintosh computers. Dvorak writes about the technical weakness of the PC's CD-ROM technology, including the lack of recognition for color bit-depths and the still-jerky full-motion video. Meanwhile, the Macintosh is already there.

Omar A. Vega
via the Internet

PC MAGAZINE CD COMES OF AGE

Having just received for the first time PC Magazine CD-ROM (discussed in the sidebar "*PC Magazine* on CD-ROM," September 13, 1994), I must say emphatically that it's great. I can read my favorite columns from an entire year all at once, or perform a search on a particular topic. As a computer professional whose work requires staying current with the industry, I recognize that this is an invaluable resource.

Christopher E. Venter
via PC MagNet

THE WIDENING RIFT

Bill Machrone wants to wait ten years so he can drag a super-PC out to the garden to measure a tree ("The Decade Ahead," September 13, 1994). I'd argue that such things as trigonometry and good writing skills are best learned in school, where they are loaded into the brain, not onto a hard disk. Will we eventually reach a point where machines become so smart that human understanding can be safely replaced by ignorance?

Alan H. Schulman
via the Internet

BREATH OF FRESH AIR

Finally, someone at *PC Magazine* writes an informative article concerning OS/2! The Extending Your Apps column "Tuning Windows Applications Under Personal OS/2," in your issue of September 27, 1994, was a very welcome relief from the steady stream of DOS/Windows literature.

Charles Pollard
via the Internet

Unbelievable. I can't believe you're actually talking about OS/2 and reviewing a few new native apps!

Murray Todd Williams
via the Internet

LOW ALTITUDES

Bill Howard's column "A Road Warrior's Wish List" (September 27, 1994) would amount to an interesting fantasy if he didn't seem to be serious about some of his economically ridiculous proposals. Two-line phones in hotel rooms, in-room safes, and even in-room printers are all nice ideas, but each represents a cost, security, and installation nightmare. However, I couldn't agree more with Howard's call for the FAA to rescind its absurd ban on laptop use during takeoff and landing: If the shielding in airplane electronics is really that inadequate then the electronic systems ought to be upgraded.

Phillip Brown
via the Internet

Is Howard such a workaholic that he totally resents being forced not to use his laptop for 20 minutes during a flight? The first and last 10 minutes of a flight are the ones most subject to turbulence, which is why everything is supposed to be stowed away in the cabin at that time. If Howard insists on using his laptop when the plane hits an air pocket, what's going to happen when the computer sails through the cabin and clobbers somebody else? He should take a deep breath and relax.

Phil Reed
via the Internet

IS PRIVACY PASSÉ?

Michael J. Miller's column "Editors in an Electronic World" (September 13, 1993) raises some thought-provoking questions concerning the future of PC technology and privacy. That the data encryption Clipper chip will be required to safeguard and protect seems to be simplistic and repressive to an industry that thrives on change.

Pascal Duke
via PC MagNet

CORRECTIONS AND AMPLIFICATIONS

The correct measurements for the diagram in "Generation X Ray," which appeared in Trends in the issue of November 8, 1994, should have been as follows: ultraviolet light: 3,650 angstroms, 365 nanometers; deep ultraviolet light: 2,480 angstroms, 248 nanometers; Xray: 10 angstroms, 1 nanometer.

Regarding "Spell-Checking for Your Apps" (Toolkits, November 8, 1994): The correct company name and telephone number information for Imagine, Version 1.5, is Imagination Software, 301-588-8411.

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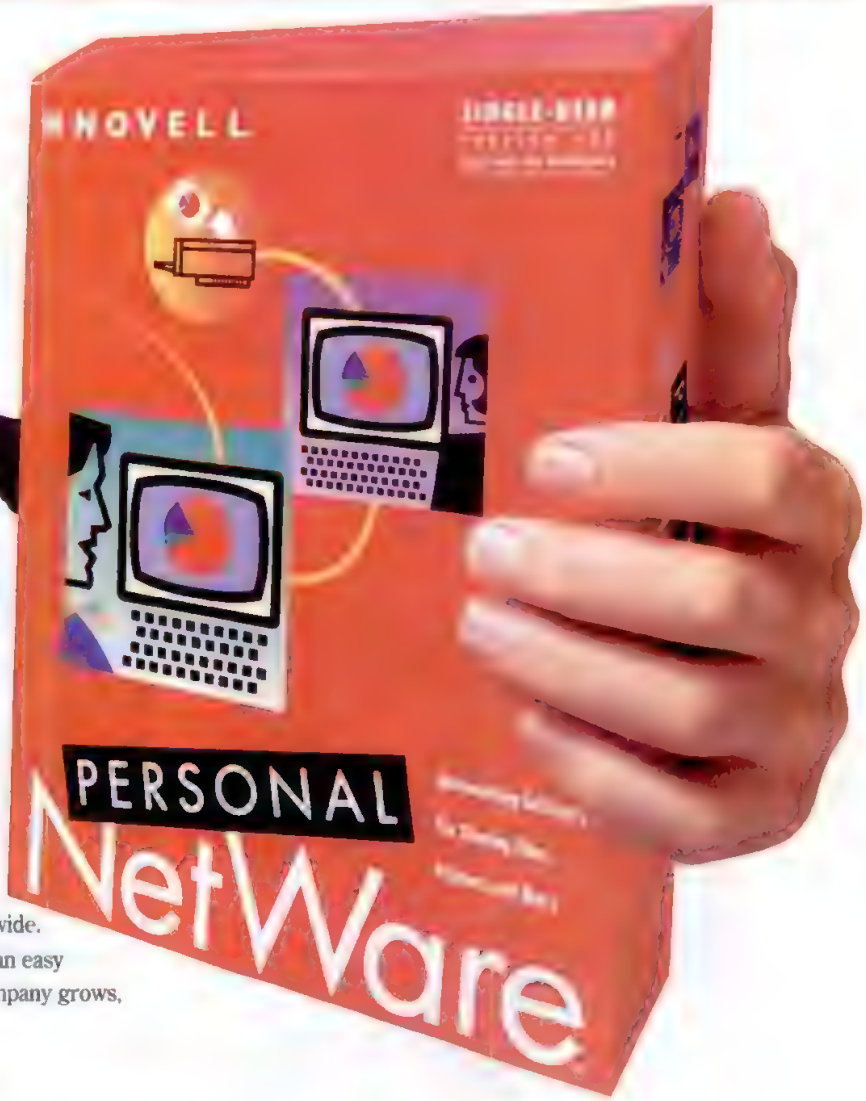

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No matter which ZEOS notebook you purchase, you can be assured you're getting the best service and support in the business! ZEOS has won six *PC Magazine* Readers' Choice for Service & Reliability awards. No company has won more.

Reach the highest point in notebook computing with the new ZEOS Meridian line. There's no limit. With its durable design, awesome performance and technologically-advanced features, you'll be able to keep in touch with the office, write memos, organize your calendar, and work on priority documents—wherever you are. For power that will take you to the highest peak, call a ZEOS Systems Consultant today at 800-554-7172.

Standard With Every ZEOS Meridian :

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- RAM expandable to 20MB.
- IDE hard drive upgradable to 350MB.
- High-speed local bus video with 1MB video RAM.
- Display: 640 x 480 color VGA backlit LCD, up to 256 colors. 400C: 7.8" diagonal STN color. 800C: 10.3" diagonal DSTN color.
- Supports simultaneous display with an external SVGA color monitor at resolutions up to 1024 x 768.
- PCMCIA slots: 400C: 2 Type II, 800C: 2 Type II or 1 Type III.
- 84-key keyboard with embedded numeric keypad and 12 dedicated function keys, inverted "T."
- Integrated TruePoint™ pointing device.
- Replaceable, rechargeable NiMH battery.
- Serial port, enhanced parallel port, external VGA video port, external keyboard or PS/2 mouse port (800C includes both). 400C also with external floppy drive port.
- Full power management features include Low Power mode and programmable Standby features.
- AC-DC adapter with full range from AC110-240V to DC.
- 400C: 7.8" x 10.2" x 1.7"; 3.6 lbs. 800C: 8.9" x 11.7" x 1.9"; 6.3 lbs.
- EPA Energy Star compliant.
- FCC Certified Class B; UL Listed.
- ZEOS Customer Satisfaction package.

Processors	Package 1		Package 2		Package 3	
	400C	800C	400C	800C	400C	800C
486SX-33	$1995	■	$2295	■	$2595	■
486DX2-50	$2195	$2495	$2495	$2695	$2795	$2995
DX4-100	$2495	$2795	$2795	$2995	$3095	$3295
Screen Options						
Meridian 400						
Monochrome Option—VGA backlit LCD, 8.2" diag. (from 400C to 400) -$300						
Active Matrix Upgrade—VGA color backlit LCD, 7.8" diag. (from 400C to 400A) $700						
Meridian 800						
Active Matrix Upgrade—VGA color backlit LCD, 9.5" diag. (from 800C to 800A) $800						
	➤ 4MB RAM ➤ 175MB IDE hard drive ➤ 800C only: Internal 3.5" 1.44MB floppy drive ➤ MS-DOS 6.2		➤ 4MB RAM ➤ 260MB IDE hard drive ➤ 3.5" 1.44MB floppy drive, 400C: External, 800C: Internal ➤ Custom carrying case ➤ MS-DOS 6.2 ➤ Microsoft Windows for Workgroups 3.11 ➤ Lotus Organizer		➤ 8MB RAM ➤ 350MB IDE hard drive ➤ 3.5" 1.44MB floppy drive, 400C: External, 800C: Internal ➤ Custom carrying case ➤ Extra battery ➤ MS-DOS 6.2 ➤ Microsoft Windows for Workgroups 3.11 ➤ Lotus Organizer	

Fax Orders: 800-362-1205 or 612-362-1205. Phone Orders: Outside U.S. and Canada: 612-362-1212, Government: 800-245-2449, ZEOS Information Systems, Inc. GSA #GS00K94AGS5176. Purchase Orders, MasterCard, VISA, Am Ex, Discover, COD and affordable leasing programs.

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CIRCLE 151 ON READER SERVICE CARD

Matt Ghourdjian
National Director of Technology
Howrey & Simon

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The Growing PowerPC Family

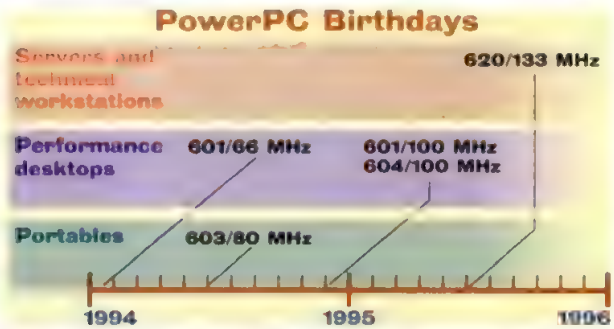
IBM and Motorola unwrap high-end chip.

Three years ago, the PowerPC camp promised a processor for every kind of computer. By this time next year, they'll have made good on that promise. First came the 601, built for mainstream desktop PCs such as Apple's Power Macintoshes. Next, IBM and Motorola served up the low-power PowerPC 603 chip for notebooks. And now, as they begin offering computer makers the 604, their new high-end desktop PowerPC processor, IBM and Motorola are taking the wraps off the next PowerPC chip.

The new chip, called the 620, is the first PowerPC processor that is designed to handle the rigors of server work. In fact, it looks more like the high-end RISC (reduced instruction set computing) chips from Digital Equipment Corp. or MIPS than a PowerPC processor. The 620 pushes well beyond existing notebook and desktop PowerPC offerings in several ways. First, the chip will be the initial 64-bit offering in the family. Early indications are that the 620 will run at 133 MHz, compared to no more than 100 MHz for the 601 and 604. The 620 will also offer a 128-bit bus to the computer's main memory—double the width of PowerPC processors today.

To help memory keep up with the faster processor, IBM and Motorola are including an on-board 64K cache, twice the size of the one inside the 604 (as with the Pentium, the 64K is divided into two separate caches—one for instructions, and one for data). It will also provide on-board hooks to a secondary cache of up to—are you ready?—128MB. And just in case you don't think this chip can handle the rigors of your workgroup alone, it's wired for company. The processor bus is equipped to handle up to four 620s without any extra support circuitry.

The 620 will be available to computer makers next summer, with servers built around the chip cropping up a few months after that. By that time, we should have a better idea of exactly what software to run—indeed, which operating system to load—on PowerPC systems. For some reason, the software side of Big Blue's PowerPC push has been as chaotic as the chip development has been orderly. Right now, there are three mainstream alternatives available or in the works: a PowerPC version of Windows NT, Apple's System 7.5, and Workplace OS (in development at IBM). Add to that IBM's home-grown Unix operating system, AIX.—*Mike Feibus*



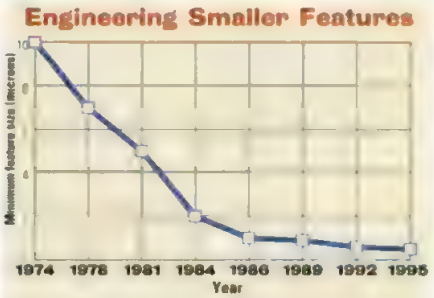
The most advanced chip in the family, the PowerPC 620 from IBM and Motorola, will be available to computer makers next summer.

Source: Motorola

RAM Revolution

THE DAYS OF EXPENSIVE MEMORY may be numbered thanks to a series of new chip designs now in development.

For the past 20 years, the storage density of dynamic random access memory (DRAM) chips has improved dramatically with the help of better memory design and manufacturing techniques. Cell densities have quadrupled every three years, while cost per megabyte has plummeted almost 40 percent annually. Unfortunately, the fundamental architecture of the DRAM interface (the way data is transmitted to and from the chips) hasn't kept up and now poses a performance bottleneck.



The continuous decrease in minimum feature size is behind the growth of DRAM capacity and speed.

Source: New DRAM Technologies by Steven A. Przybylski, MicroDesign Resources

A popular new DRAM technology that system and graphics board designers are now evaluating is called *extended data out* (EDO), also known as hyper-page mode (a *page* is a slice of 2,048 bits within a row of memory on a DRAM chip). EDO speeds memory by up to 30 percent by allowing one cycle to start before the previous cycle has been completed. Widespread adoption of EDO memory designs is expected sometime in 1995, when DRAM chips will incorporate EDO control mechanisms at minimal or no cost.

Even more advanced DRAM technologies are on the horizon, including cache DRAMs, synchronous DRAMs, Rambus DRAMs, and Ramtron International's Enhanced DRAMs. Some system vendors are reluctant to consider EDRAM because of a limited number of suppliers, but PC Magazine Labs expects to see EDRAM-based systems soon.—*Nick Stam*

Pipeline *By Robin Raskin*

Born-Again Products

Poring over the latest crop of product announcements, I'm struck by that "been there, done that" feeling. Many of these new kids claim that they're conquering uncharted territory. In fact, they're gambling that the time is right to provide answers to yesterday's not-quite-solved problems. Here are some products I expect we'll be revisiting in the coming year. Makes you think that there's nothing new under the sun.

• **Hydras.** A few years ago, a handful of companies promised us a compact solution for the home office—a printer, scanner, copier, and fax all rolled into one. At best, these products worked passably. They used thermal paper and produced illegible scans and copies. Okidata's Doc-It almost got it right in 1992, but it was pricey, slow, and relied on an add-in board.

Now these hydras are back. There are some, like the QMS 2001 Knowledge System, for heavy-duty office environments ($5,000). Others, such as the Hewlett-Packard OfficeJet and the Panasonic PFC, sell for under $1,000 (print, copy, and fax only). Xerox just introduced a family of hydras with an optional scanner module. These seem to be a generation of truly useful machines: plain-paper fax, OCR, and high-resolution printing.

• **Ergonomic keyboards.** I suppose we had to wait for Compaq and Microsoft to legitimize the need for ergonomic keyboards with their warnings concerning keyboard usage. Some of the early ergonomic keyboards were viewed as products for the lunatic fringe. My first encounter was with a bizarre-looking sinusoidal-shaped keyboard called The Wave. Today, the Microsoft Natural Keyboard suits me quite well, although the keyboard is long, so your mouse is further away from you than ever.

• **Adaptive-line modems.** In 1985, our award for Technical Excellence went to Telebit Corp.'s Trailblazer, the first modem that could change its speed and adapt to different baud rates. The new V.34 modems have finally made this feature a standard for all of us—ten years later.

• **Home applications.** Many companies have gone out of business trying to figure out what consumers want to do with their home PCs. Most recently, SoftKey bet its future on a product called Kaboodle. It went nowhere. An early product called WomensWare tried to help women create a database they could manage the house with. The list goes on and on. In early 1995, Microsoft will release Utopia, an integrated package for getting a grip on many aspects of your home life. Microsoft has put three years of research into the development of a social interface that will meet the needs of the "everyman" consumer. Let's watch and see if Microsoft gets an "A" in human psychology or not.

• **Infrared.** The original IBM PCjr used infrared to transmit keystrokes. Infrared is still hard at work in products like the HP 100LX and the HP OmniBook, as well as in the new IBM ThinkPad notebooks, many of Extended Systems' peripherals, and now in the Sony Magic Link.

• **Telephony.** Nearly a decade ago, Compaq built a cool machine that integrated an XT-class PC with a built-in modem, a two-line telephone, speed-dial buttons, and a dialing directory. Today, AT&T has reincarnated the TeleCompaq in the Globalyst line. The phone is now a full-duplex speakerphone that sounds terrific and includes built-in voice mail, fax, a DSP processor, stereo speakers, and a microphone.

Very retro. The more things change, the more they stay the same. But with these products, they stay the same while getting better all the time.

Robin Raskin is the editor of PC Magazine.

The Real Cost of Windows 95

WILL YOU JUMP ON WINDOWS 95 as if it's a $20 bill on the sidewalk or wait for something in a higher denomination—say, Windows 95.1? The answer may depend on whether you're shopping for one user or several hundred users.

Consumers eagerly anticipate the nonsegmented memory, long filenames, and other improvements in this watershed revision, but corporate buyers are cautious. After all, they may have to spend as much as $650 per user to support a $50 piece of software, according to Gartner Group estimates. Besides, "no one in their right mind accepts Version 1 of an operating system and migrates mission-critical applications to it," says Marc Litvinoff, Gartner Group vice president. "You want to wait until the inevitable maintenance release shows up—Windows 95.1."

PC makers are finding themselves on the upgrade treadmill—Microsoft's bread and butter. (Microsoft expects to sell 40 to 50 million copies in 12 months.) The name "Windows 95" suggests that there will be a yearly cycle: Windows 96, Windows 97.... And that worries Dan Sheppard, director of business desktops at AST, who wonders how consumers will react to an AST Advantage PC in 1996 with "last year's operating system" on it.

Size is another issue. A joke circulating on the Internet suggests that Windows 95 refers to the number of disks required to load it and the number of megabytes needed to store it. Microsoft says Win95 will need around 25MB, which leaves PC vendors shipping at least 10 floppies. The obvious solution is to ship the software preloaded on the hard disk, with a mirror image of the disk and on-line manuals on a single CD-ROM. And with prices of CD-ROM drives dropping, AST, Dell, and NEC expect to equip most systems with CD-ROM drives by Win95's debut next spring.

There's no sign yet that Microsoft will charge PC makers or consumers more for Windows 95 than for Windows 3.1. Chances are that Microsoft will offer deep discounts for a limited time.—*Mike Hogan*

Upgrade Costs per User

	Best case	Worst case
Planning	$9.30	$2.58
Acquisition	$37.64	$51.00
IS preparation	$6.12	$16.20
Installation	$52.50	$337.25
Training	$47.76	$121.36
Tech support	$52.67	$111.33
Administration	None	$65.50
Total	$205.99	$705.22

Note that careful planning can result in a lower total cost. Beyond the cash outlay, plan to invest 5 to 16 hours to upgrade each user to Microsoft Windows 95.

The Shrinking PCMCIA Card

IMAGINE SNAPPING A SERIES OF digital images with an inexpensive hand-held camera, then transferring the image files simply by popping a tiny storage card out of the camera and into your PC. Or imagine downloading your messages from your cellular phone using the same matchbook-size device. That's the vision SunDisk Corp. has for CompactFlash, its new, even tinier-than-standard PCMCIA flash memory technology. The devices will initially be available in 2-, 5-, 10-, and 15MB capacities.

CompactFlash, is slightly larger then a matchbook.

The question, however, is whether smaller is really better in a market that has already proved slow to adopt standard-size PCMCIA cards. "The reality is that CompactFlash represents yet another aberration to the PCMCIA specification, and PCMCIA's largest barriers today revolve around compatibility issues," says Dataquest analyst Rod Watkins. He believes that trying to create an additional PCMCIA industry standard, especially a de facto standard, "will increase the level of confusion and incompatibility that already exists."

Such pessimism may overlook potentially large markets. CompactFlash cards are electronically compatible with standard PCMCIA flash memory cards, and that compatibility may drive increased interoperability between PCs and forthcoming devices such as digital cameras, personal digital assistants, and cellular phones.

An inexpensive adapter will plug CompactFlash directly into standard PCMCIA Type II slots on desktop PCs and notebooks. This crucial link will allow digital cameras to share image files with PCs directly, without the need for any cables. And cellular phones and PDAs could share phone lists and other data with desktop or notebook computer systems.

A PCMCIA Type II adapter guarantees compatibility.

If CompactFlash does indeed catch on in future hand-held devices, it could eventually become as popular as the standard PCMCIA cards now readily available on the market, says Gerry Purdy, editor in chief of *Mobile Letter*. A steady stream of support announcements from hardware manufacturers over the next six months will be important to the success of CompactFlash.—*Jonathan Karl Matzkin*

Top Retail Software

Current ranking	Last issue	Product/ company
1	1	**MS-DOS 6.22 Upgrade** *Microsoft Corp.*
2	6	**QEMM 7.5** *Quarterdeck Office Systems*
3	5	**MS Windows 3.11** *Microsoft Corp.*
4	3	**Procomm Plus for Windows 2.0** *Datastorm Technologies*
5	4	**Internet Membership Kit 1.0** *Ventana Media*
6	—	**MS Office 4.2 for Windows Upgrade** *Microsoft Corp.*
7	—	**Uninstaller 2.0** *MicroHelp*
8	—	**Quicken 4 Deluxe CD** *Intuit*
9	8	**Procomm Plus 2.01** *Datastorm*
10	—	**Color Clipart 1.0** *Expert Software*

This list ranks PC business programs according to the total number of copies shipped to over 12,000 stores and resellers in the week ending October 15, 1994; the list cannot be interpreted as a picture of the entire software market. Adapted from a compilation by Ingram Micro.

Here's Looking at You

HOW WOULD YOU FEEL IF YOUR mouse became extinct because your computer was able to see you and react to your movements? It may happen with the help of *neuromorphic* software techniques under development at Synaptics, a San Jose, California company that is working on the architectural blueprints for *intuitive computing*. In other words, we can look forward to the day when computers will adapt to us so that we don't have to adapt to their constraints.

Future neural network touchpads can be printed on mylar.

And it's not all theory. Synaptics recently introduced a new membrane touchpad that works as a pointing device. Unlike other touchpads, Synaptics' TouchPad has a *z-factor* that senses pressure, which is needed for handwriting and painting. Until now, pressure sensing was available only in costly graphics tablets.

The sensor is also unique because it doesn't have to be manufactured on a conventional circuit board. Instead, the sensor's circuitry can be printed with silver/carbon conductive ink onto the equivalent of a mailing label that you can stick on any curved surface. A neural network chip enables the Touchpad to adapt to different surfaces and shapes. Epson and Twinhead plan to use the TouchPad in future notebooks.

Carver Mead and Federico Faggin—the founders of Synaptics—have been at the forefront of many breakthroughs in microcomputer technology, from advances in the basic structures of integrated circuits to the development of the first microprocessor. Now, they're working to push the computer beyond its expertise in logical computation, in which it performs a programmed sequence of instructions on precise input to produce precise output. Neural networks perform intuitive computation—in other words, they learn by example. This enables sensory-based pattern recognition—seeing, hearing, speaking.

Synaptics' electronic eye uses a neural network chip to "see."

Synaptics is also developing an electronic eye—a silicon retina—based on a neural network chip and lens that would be built into monitors and would recognize gestures. Artists could manipulate three-dimensional graphics objects on-screen, and kids could interact with computer games without special data gloves or headsets. The company is also working on an advanced speech-recognition system based on wavelet processing, and a handwriting-recognition engine that adapts to your writing style.—*Carol Levin*

Can You Trust Digital Bucks?

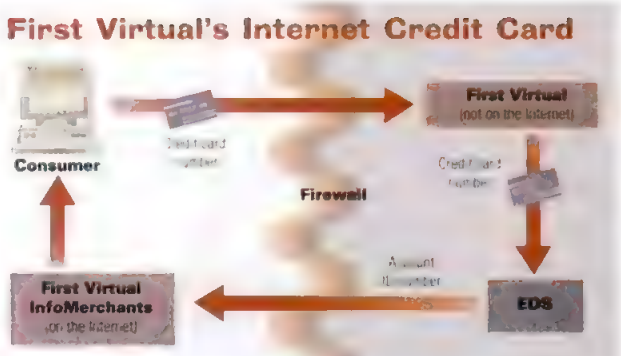
FINDING A SIMPLE, RELIABLE WAY for people to buy and sell information and goods over the Internet is the next step to the widespread commercialization of the Internet. But are you willing to type in your credit card number?

Just the thought of sniffer programs that rout out credit card numbers en masse is enough to keep consumers away from on-line shopping. And at a time when people are considering banking by PC, electronic security is even more important.

To win over Internet shoppers, several companies have recently drawn up plans for secure electronic payment systems that thwart on-line criminals. First Virtual Holdings, a startup based in cyberspace (info@fv.com and http://www.fv.com) recently launched an innovative on-line transaction system. "We dispense with complicated encryption," explains Nathaniel Borenstein, chief scientist at First Virtual. Instead, the company circumvents the Internet by handling all financial transactions and credit card authorizations behind several *firewalls* at an EDS Bank Card Processing Center in Ohio and First USA Merchant Services, a credit-card company.

First Virtual charges a registration fee of $2 for consumers and $10 for sellers; it also gets a 2 percent fee from each sale. To open a First Virtual account or to start selling your own information services out of their Infohaus server, send an e-mail message to apply@card.com or telnet to telnet.card.com.

Several other companies are currently working to address the security issue with digital scrambling technology. The forthcoming version of Enhanced NCSA Mosaic, from SpyGlass Inc., will authenticate the identity of sellers and transmit credit-card information securely over the Internet with the help of Secure-HTTP software from Enterprise Integration Technologies and RSA public key cryptography.



After you punch in your credit card number over the phone, First Virtual sends it to secure computers at Electronic Data Systems.

Meanwhile, Open Market, a startup in Cambridge, Massachusetts (617-621-9500), has developed StoreBuilder, a software kit for creating a secure storefront on the Internet.—*Carol Levin*

Voice Mail on Steroids

VOICE MAIL HAS DONE MORE FOR traveling businesspeople than promote games of phone tag: It lets us be in two places at once. Software developers are now exploring the next generation of voice-mail systems that, with the help of PCs, do much more than take messages for you.

"The next generation of telephone systems will seem like voice mail on steroids," says Nicholas D'Arbeloff of Wildfire, developer of a voice-activated phone system. Wildfire, which uses a Unix server, acts like a digital assistant that gets messages to you when and where you need them. It's based on recorded sound bites and voice recognition, so interaction is relatively natural. A typical Wildfire dialogue might go something like this:

"Wildfire."

"Here I am."

"Any messages?"

"Message from John Smith."

"What's it say?"

"This is John Smith, call me when you get a chance.

"Call him right away."

Another approach to future-phones pushes the technology even further by using speech synthesis rather than recorded sound bites. Running on PC servers, CallExpress3 from Advanced Voice Technology uses the phone's touch-tones as an input device. As an extension of your company's network, the software can transfer faxes and read e-mail to you. For instance, rather than using a notebook PC to download your e-mail from the company's server, you can call your company's AVT phone server, and a synthesized voice will read you your e-mail. At any time, you can instruct the system to fax the document to you.

These first attempts at transforming the telephone into an extension of your office network point to a time when the phone could augment the notebook PC for the traveling executive.—*Brian Nadel*

Briefs

CNN AT WORK, A JOINT PROJECT BETWEEN Cable News Network and Intel, has started delivering live news feeds to corporate networks. Designed to keep employees up to date on important-business news and world events, the programming offers Headline News, CNN, and stock feeds. The system takes advantage of multicasting technology to deliver audio, text, and compressed digital video efficiently at 10 to 12 frames per second. Contact Intel and CNN at 800-538-3373, ext. 130, for more information.

***BUSINESSWEEK* AND *NEWSWEEK* ARE THE** latest magazines to go on-line. BusinessWeek Online is slated to debut on America Online by year's end, and Newsweek InterActive is now available on Prodigy. Time Online, which is now on AOL, is venturing onto the Internet with its own World-Wide Web server.

YOUR NEXT NOTEBOOK MAY COME WITH battery software that displays vital statistics such as battery chemistry, capacity, status, and remaining percentage of battery life. Duracell and SystemSoft Corp. are developing the smart battery software they expect to deliver to notebook manufacturers early next year.—*Carol Levin* and *Melissa Perenson*

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PC Magazine Editors' Choice — April 12, 1994 Pentium-66

"In terms of performance, the Pantera-66 left little to be desired...this machine laid claim to no low scores whatsoever."
PC Magazine *Editors' Choice*

Windows Sources Experts' Pick — June 1994 Pentium-66; August 1994 Pentium-90

"ZEOS Pantera rose above the crowd and posted the most impressive performance numbers."
Windows Sources *Experts' Pick*

PC Computing BEST — May 1994 Pentium-66

"A standout in speed and value...we suggest you spend your money on this machine – it offers the best value of any system we tested."
PC/Computing *BEST*

Computer Shopper — June 1994 Pentium-60; August 1994 Pentium-90

"ZEOS set the standard... the obvious choice among the group."
Computer Shopper *No. 1 Choice*

Windows Magazine 1994 Recommended — November 1994 Pentium-90

"This was one of the fastest machines we reviewed."
Windows Magazine *Recommended*

PC World Best Buy — December 1994 Pentium-60; November 1994 Pentium-90; October 1994 Pentium-90; September 1994 Pentium-90; September 1994 Pentium-66; August 1994 Pentium-90; August 1994 Pentium-66; July 1994 Pentium-66; June 1994 Pentium-66

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PC World *Best Buy*

Editors' Choice, Experts' Pick, Recommended & No. 1 Choice ZEOS PC

Pentium-60	**$2745**
Pentium-66	**$2895**
Pentium-90	**$3045**

- Intel 60MHz, 66MHz or 90MHz Pentium CPU
- 16MB RAM, 256K SRAM cache
- 528MB local bus IDE hard drive, 256K cache
- 2X CD-ROM, 3.5" 1.44MB floppy drive
- Diamond Stealth 64/PCI local bus SVGA color graphics card with 2MB VRAM
- 15" 1024 x 768 non-interlaced SVGA color monitor, .28mm dot pitch
- 2 high-speed serial ports, 1 enhanced parallel port
- Integrated business audio
- Optional on-board Fast SCSI-2
- Optional on-board PCI local bus Ethernet LAN (Pentium-90 only)
- 10-bay vertical case with two cooling fans
- 101-key space-saving keyboard
- Microsoft DOS 6.2 with Enhanced Tools, Windows for Workgroups 3.11, Lotus SmartSuite

intel inside pentium processor

BEST & Experts' Pick ZEOS Multimedia PC

Pentium-60	**$3268**
Pentium-66	**$3418**
Pentium-90	**$3568**

The above PC modified to include:
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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

■ Network Operating Systems

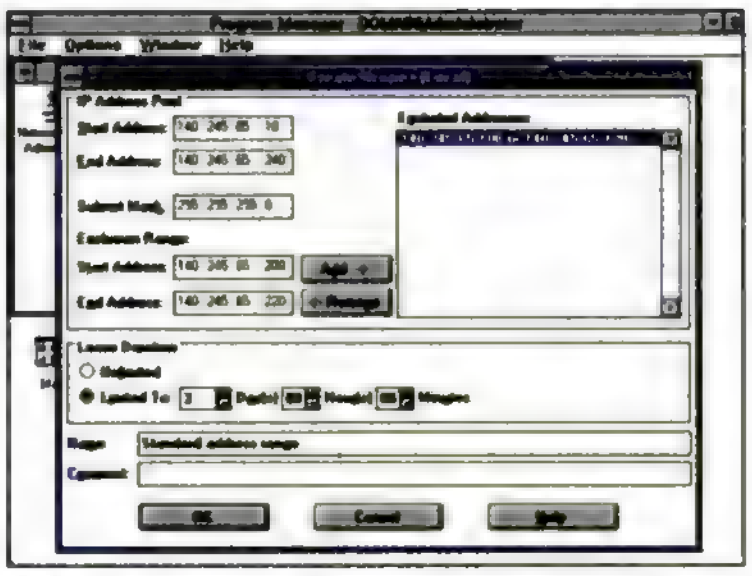
Windows NT Server 3.5: Microsoft Gets Serious About Enterprise Computing

BY MARK JONIKAS

With Windows NT Server 3.5, Microsoft shows that it wants to move beyond the desktop and workgroup and fully enter the realm of enterprise computing. This version of NT for servers provides greater ease of administration, interoperability with other networks, and a slew of new tools and features. Add to that performance that is slightly improved over Windows NT, Version 3.1, but much better than SCO Unix, and you have a competitive network operating system.

Windows NT is now two distinct products that share a common architecture and some features, such as support for multiple protocols and long file names. As the names imply, Windows NT Workstation 3.5 has been optimized for the desktop, while Windows NT Server 3.5 aims at being the ideal server.

The big news is the scope of NT Server 3.5's ability to interact with Novell's NetWare and other non-Microsoft networks. The Gateway Service for NetWare within NT Server 3.5 allows networked Windows for WorkGroups and DOS clients to access file and printer resources on NetWare-based LANs. With NWLink, NetWare clients can access applications such as Microsoft's SQL Server and SNA Server on an NT server without changing software; we found that the applications appear as if they were running on a NetWare server. NT Server 3.5's Migration Tool for NetWare automatically populates user accounts by copying files and account information—including user rights and permissions—from NetWare servers and converts them for use by NT Server 3.5. The migration tool cannot read NetWare passwords, however.



POPULATE: *Configuring user accounts for an NT Server–based network is as easy as setting addresses and length of access.*

For Wide Area Networking, TCP/IP is as close to a corporate standard as exists today, and NT Server 3.5 offers the ability to allocate and administer addresses for client workstations. The use of the Dynamic Host Configuration Protocol allowed us to manage and distribute IP addresses for client nodes without actually configuring the workstations.

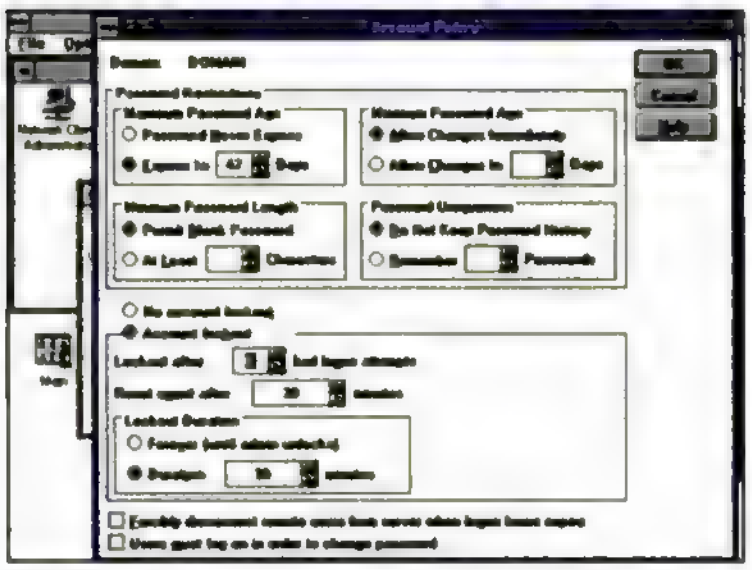
The Windows Internet Naming Service provided a dynamic mechanism for host-name-to-IP address resolution that diminished broadcast message traffic and reduced dependency on static Domain Naming System tables, which require continual maintenance.

In addition, NT Server 3.5 now offers support for TCP/IP-based printers as well as file transfer protocol. By including SNA's DLC protocol, NT Server 3.5 can talk to mainframes via 3270 emulation. Macintosh users may be pleasantly surprised to find a new icon on their desktop—a server with an NT flag logo, which will give them new connectivity options.

NT Server 3.5 is more flexible than its predecessor, giving users the choice of NetBEUI, SPX/IPX, or TCP/IP on start-up; Windows NT 3.1 loads NetBEUI by default.

Dial-in connections to a server are accomplished through Microsoft's Remote Access Service. Each server can now

Continues on page 38



PROTECT: *NT Server's built-in security allows account lockout after a preset number of unsuccessful attempts to log on.*

FIRST LOOKS PLUS

From December 5 through 12, you can go on-line to discuss Microsoft's new Windows NT Server, Version 3.5, with reviewer Mark Jonikas; and Mike Walsh and Biki Malik, product mangers for Windows NT. Type GO EXEC at any CompuServe ! prompt.

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Photography by Thom O'Connor

Windows NT Server

CONTINUED FROM PAGE 37

support up to 256 sessions, compared to 64 in Windows NT 3.1. The connection is transparent to the user, although operations will be slower, as phone lines are used for transmission.

In terms of security, NT Server 3.5 is organized around the concept of domains, and security is maintained by a machine designated as a domain controller. File and directory rights are managed by the File Manager. The main addition to the security infrastructure in NT Server 3.5 is an account lockout feature, which will lock a user's account after a specified number of unsuccessful log-on attempts.

In order to scale performance of a server to meet a company's changing needs, NT Server 3.5 supports symmetrical multiprocessing for up to 4 CPUs out of the box. While 32 CPUs is the design limit of the operating system, this will only be available through an independent software vendor. NT Server 3.5 can accomodate CPUs from Digital, Intel, and MIPS. Like OS/2, NT Server 3.5 can execute multiple threads, which spreads execution more efficiently over multiple processors. The operating system now takes care of scheduling, as well as the coordination of asynchronous I/O operations, so that the system is not held up by processes waiting on slower resources.

PERFORMANCE RESULTS

We configured a 66-MHz Pentium-equipped Compaq ProLiant 2000 server with several network operating systems and ran the ServerBench 1.1 test on a network of 60 PCs. We found that in single-processor configuration, NT Server 3.5 gave maximum throughput of 10.3 transactions per second (TPS) at four workstations, 4 percent more than Windows NT 3.1 and 20 percent more than SCO Unix. In dual-CPU configuration, it gave a maximum throughput of 16.6 TPS at a load of eight clients, an improvement of 61 percent over its single-CPU performance. This level of throughput represented a 6 percent performance boost over Windows NT 3.1 and a 57 percent gain over SCO Unix.

By charging for NT Server 3.5 on a per-server and per-client basis, Microsoft sets the pricing pace as well. Each server costs $699, a single-client license costs $39.95, and discounted multiple-license packs are available. A 100-node, single-server NT Server LAN will cost $3,544, while a similar setup based on NetWare, Version 4.02, would cost $8,795; with two or more servers, the savings increase.

Overall, as a 32-bit preemptive multitasking operating system with multiprocessor capability, NT Server 3.5 is a serious competitor against Unix network operating systems. The package excels in setup, presents an easier administrative interface, and is outfitted with a group of excellent performance-tuning tools. Its closest competitor in terms of administrative ease is IBM's AIX Unix operating system with its SMIT windows-based administration tool.

NetWare and Unix are strongly established network operating systems. NT Server 3.5, however, is a viable competitor in terms of features, performance, and price.

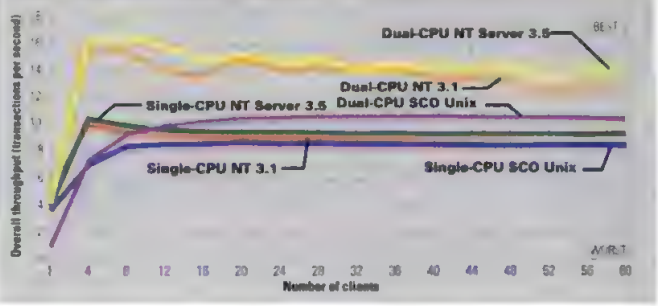
▶ **Microsoft Windows NT Server 3.5.** List price: *$699; client license, $39.95.* Requires: *16MB RAM, 110MB hard disk space.* Microsoft Corp., *Redmond, Washington; 800-426-9400, 206-882-8080.*

Circle 439 on reader service card

Benchmark Tests: Microsoft Windows NT Server 3.5

Microsoft Windows NT Server, Version 3.5, outperformed its predecessor, Windows NT 3.1, by only a small margin in single- and dual-processor configurations, but it did quite a bit better than SCO Unix on our tests. Adding the second CPU to NT Server 3.5 increased throughput by about 60 percent.

We used a set of tests from ServerBench 1.1 with a 60-workstation network and a Compaq ProLiant 2000 server.



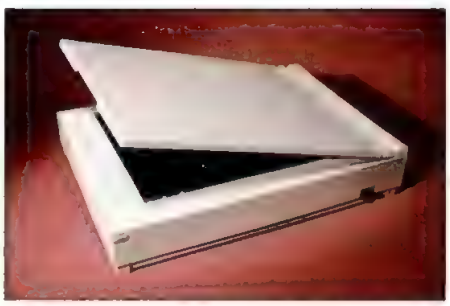
■ **Scanners**

Two of a Kind Scanners Move Words And Images from Page to PC

BY ALFRED POOR

With price tags of under $600, the most recent flatbed scanners from Canon and Hewlett-Packard are intended to attract buyers who might otherwise use hand-held scanners. Based on the same Canon 300-dot-per-inch engine, the HP ScanJet 3p and Canon IX-3010 scanners use SCSI interfaces to produce high-quality 256-gray-scale images. Each of these 8-bit scanners includes optical character recognition (OCR), image-editing software, and can—along with a suitable printer—function as a convenience copier. Both models also feature an optional paper feeder, so they can serve as the basis of an office's digital archiving system.

In spite of all these similarities, however, each scanner will appeal to a different buyer. The ScanJet 3p is faster and can do more automatically. The IX-3010, on the other hand, gives the user a greater degree of control.



SPEED: *The HP ScanJet 3p is a fast scanner that offers many automatic features.*

HP SCANJET 3P

The focus of the ScanJet 3p is on ease of use, and its Twain-compliant driver makes it a snap to configure and use within a variety of Windows applications.

Setup is simple: The scanner carriage locks and unlocks with the twist of a penny. The SCSI interface is easy to configure (and comes with a convenient 6-foot cable), and you get an external terminator for the scanner.

The included PictureScan software is accessible through the Twain driver, and provides automatic control of scan settings. The software can also automatically find the image on the 8.5- by 11.7-inch scan bed by using a prescan; the image's edge is located either by a rectangle or a lasso mark. You can organize images as thumbnail views with the included PicturePlace software, which also includes an edi-

tor that lets you perform minor alterations to the image. The editor has a straight-edge tool, which we found useful for quickly changing the alignment of an image that was scanned at an angle.

The ScanJet 3p includes a copy utility that turns the scanner and your printer into the equivalent of a photocopier, complete with brightness controls, enlargement and reduction adjustments, and multiple-copy capability.

Calera's WordScan OCR program is included with the ScanJet 3p and, along with HP's AccuPage technology, it improves both the speed and accuracy of OCR. Within the package, you can adjust contrast and other settings—further improving the accuracy of scanned documents.

The ScanJet 3p was blazingly fast, managing to scan a 5- by 7-inch photograph at 300 dpi in just 12 seconds. The scanner's 300-dpi optical resolution can be enhanced to 1,200 dpi. On our test scans, there was an occasional tendency to produce jagged edges when the image was printed on a continuous-tone printer; printing the image in half-tone mode improved image quality. We found that the HP's automatic settings not only produced fast scans but excellent image quality, as well.

The HP ScanJet 3p is an easy way to get text and graphics off paper and into your computer.

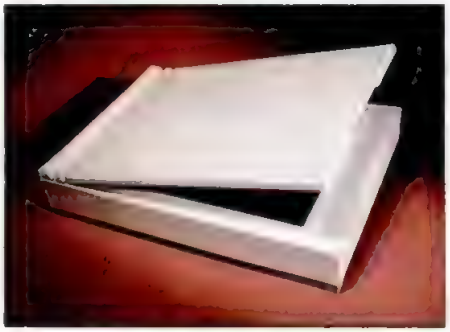
CANON IX-3010

The emphasis of the Canon IX-3010 scanner is on control. While the model requires more of your time and effort to use than the ScanJet 3p, it rewards you with greater flexibility.

Installation is, again, rather simple, though the 3-foot SCSI cable could prove a hindrance for some users. Also, the SCSI terminator goes between the cable and the scanner, which is unusual but well-documented in the instructions. You have control over the scanning settings through the unit's Twain module: Contrast, brightness, gamma settings, and resolution are adjustable, but you don't get the same level of automatic settings as you do with the HP.

We found the Canon's scanning module to be awkward. If you cancel a scan, for example, the module closes and returns you to your application. Furthermore, if you select an area to be scanned and then use the scanning module's Zoom feature, the selection setting is lost and you have to repeat your selection. If you don't make a selection before Zooming, however, you get an error message.

The Caere OmniScan OCR software can be called from within a Microsoft Windows-based word processing program.



CONTROL: *The Canon IX-3010 scanner gives you a lot of control over your images.*

Also included with the scanner is Caere's PageKeeper Portfolio document-management program, which allows you to search for scanned documents in a database. The IX-3010 also includes Image Assistant, which is a more sophisticated image editor than the one provided with the ScanJet 3p. Image Assistant provides more complex filters and editing functions.

The Canon scanner was considerably slower than the HP on our tests. It took 36 seconds to scan the same 5- by 7-inch photograph at 300 dpi. And while the IX-3010 does offer higher resolutions than the ScanJet, these exacted a performance penalty: the same image took 136 seconds to scan at 600 dpi, and 424 seconds at 1,200 dpi.

On a continuous-tone printer, the scanned images were noticeably smoother than the ScanJet 3p's. Yet the Canon's default settings did not produce images as good as those created by the HP's automatic exposure.

Both scanners come with extensive warranties. For the IX-3010 scanner, Canon includes a two-year warranty with Instant Exchange overnight exchange service, plus toll-free technical support, fax-back information, and on-line technical information. HP backs its ScanJet 3p scanner with a one-year parts and labor warranty, including HP Express Exchange for overnight replacement. The company also provides toll-free access to recorded and fax-back support materials, and free (toll call) access to technicians during the warranty period.

If you're looking for a more sophisticated package that gives you greater control, the Canon scanner, which could be available for as little as $400, is a better value. But the HP scanner offers more automatic image processing and faster scans. Which you decide on will depend as much on your wallet as your patience.

▶ **HP ScanJet 3p.** List Price: *$599; automatic document feeder, $239.* Hewlett-Packard Co., Direct Marketing Organization, *Santa Clara, California; 208-396-2551.*

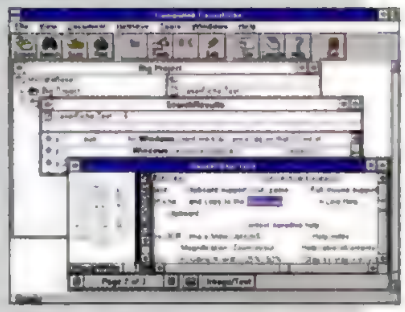
Circle 436 on reader service card

▶ **Canon IX-3010.** List Price: *$569; automatic sheet feeder, $349.* Canon Computer Systems Inc., *Costa Mesa, California; 800-848-4123, 714-438-3000.*

Circle 437 on reader service card

Ending the Paper Chase

Scanners may help you dispense with paper documents, but how do you find the digitized image of that memo or invoice your job depends on? LaserFiche, a $495 program from Compulink Management (310-212-5465), can handle the entire process for you, from scanning and OCR to filing and retrieval.



FIND: *LaserFiche's search engine displays a document in both graphics and text forms.*

The Windows program comes in several versions, including a standalone product and a client-server version for NetWare. The package lets you scan multipage documents and store the images in a database; you can assign keywords for various categories to aid in retrieval. The search engine supports a range of features, include a "fuzzy" search mode. The program can be used to perform OCR on the documents, and it gives you the option of indexing the text so you can search the contents of the documents, as well.

The version we tested had its own OCR module, but by the time you read this, the package will include Calera's WordScan Plus OCR engine. Compulink intends to add support for gray-scale (and eventually color) images, plus import and export support for Microsoft Word for Windows and WordPerfect for Windows document files.—*AP*

■ **Image-Editing Add-Ins**

KPT: Essential Image Equipment

BY JEFF MACE

Kai's Power Tools (KPT), Version 2.0, might be the easiest way to design that particular special effect, texture, or gradient you're looking for. This $199 program packs a powerful image-editing punch and is truly a "must have" utility for anyone doing serious photo illustration or design work.

Because of its popularity, KPT is now supported by a wide range of image-editing packages, such as Adobe's PhotoShop, Corel's PhotoPaint, Deneba Software's Canvas, Fractal Design's Painter, and Micrografx's Picture Publisher. KPT can be used with any application that supports the Adobe plug-in standard.

Anyone who uses scanned images for business graphics, presentations, or newsletters will be impressed by KPT's Sharpen Intensity filter. In testing, we found that this valuable single-pass filter brings images to life better than the standard sharpen filters that come with image-editing packages. Color production professionals who convert images between RGB and CMYK color modes will find this filter an essential feature.

KPT now boasts many new image-manipulation filters that produce astounding effects. One of most interesting is Vortex Tiling, which distributes an array of the image in kaleidoscopic spirals.

Several of KPT's components have undergone needed user interface overhauls, including the Gradient Designer, Gradient Designer on Paths, Fractal Explorer, and Texture Explorer. The new interfaces may look intimidating—even radical at first—but they're well documented and work like a charm after some experimentation and experience. Unfortunately, the standard Windows fly-out menus tend to look a little out of place.

Many new features offer greater control. In the Texture Explorer, we found that the action buttons, which are normally blended into the background, become highlighted for easy recognition as the mouse passes over them. You can also open the Gradient Designer while you're working in either the Texture or Fractal Explorer modules. Since the Gradient Designer is directly coupled to these modules and represents the current color scheme, you can now work directly in CMYK color space; this can streamline work on a complicated image. We found that the ability to preview the effect is also a welcome new feature.

CREATIVE POWER: *By working with popular image-editing programs, Kai's Power Tools lets you create just about any design you can imagine.*

With Version 2.0, Kai's Power Tools has become an even greater asset to image editors and designers.

▶ **Kai's Power Tools, Version 2.0.** List price: *$199.* Requires: *4MB RAM, 3MB hard disk space, Microsoft Windows 3.1 or later, an image-editing program that supports Adobe's plug-in standard.* HSC Software Corp., *Carpinteria, California; 805-566-6200; fax, 805-566-6385.*

Circle 435 on reader service card

■ **Scanners**

StudioScan II: Agfa Goes Mainstream

BY LORI GRUNIN

Agfa's presence in the scanner market has tended to be concentrated on the Macintosh platform and geared to the rigors and quality requirements of service bureaus and pre-press operations. With its StudioScan II, however, Agfa is taking aim at the mainstream PC user.

The StudioScan II's estimated street price of $995 is comparable to the price tags of the Canon IX-4015 and the HP ScanJet IIc. When comparing these 400-dot-per-inch scanners, however, bear in mind that Agfa does not include a SCSI adapter with its StudioScan II. Setting the unit up with an Adaptec SCSI card went smoothly, and the package produced satisfactory results. Although Agfa claims 30-bit color depth for the StudioScan II, it's really a 24-bit scanner that uses three 10-bit analog-to-digital converters; scan quality is slightly better than a 24-bit scanner.

SCAN: *Agfa is reaching for a mainstream market with its StudioScan II.*

The excellent Twain driver offers a broad selection of controls, including batch scanning, highlight and shadow point settings, and halftone parameters. You can set the Dmax and Dmin (a dark-to-light optical density range) for the scan target. While this flexibility is likely to be welcomed by high-end users, it is a feature that may be beyond most mainstream users. Furthermore, the software documentation may be confusing to PC users—not only because it's written for both the Mac and PC, but also because it covers a wide variety of scanners.

The automatic settings work fairly well, but there's no way to create an input-output calibration for quick scans, as you can with most scanners at this end of the market. And Agfa's quick-and-dirty scan program, FotoSnap, won't help. The unit does come with FotoTune Light, a version of Agfa's color-management system, but this software has only a small selection of supported devices. Adobe Photoshop LE also ships with the scanner.

Options include an automatic document feeder and a transparency adapter; the unit can handle pages up to legal size or transparencies up to 8 by 10 inches. With a dynamic range of 2.4D, though, the StudioScan II isn't really suited for scanning transparencies or slides, which require an optical density of at least 3.0D.

The StudioScan II is a system aimed specifically at mainstream PC users, yet it remains faithful to Agfa's roots.

▶ **StudioScan II.** Estimated street price: *$995.* Requires: *SCSI adapter.* Agfa, *Wilmington, Massachusetts; 800-685-4271, 508-658-5600; fax, 508-658-4193.*

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■ Anti-Virus

VirusScan 2.1 Eases PC Immunization

BY NEIL RUBENKING

McAfee's VirusScan has long been a dependable DOS-based anti-virus package, and with Version 2.1, the $129.99 program extends into Windows territory with a new interface that greatly simplifies its operation. However, you can still operate VirusScan entirely from the DOS command prompt—a necessity to recover from an actual virus infection.

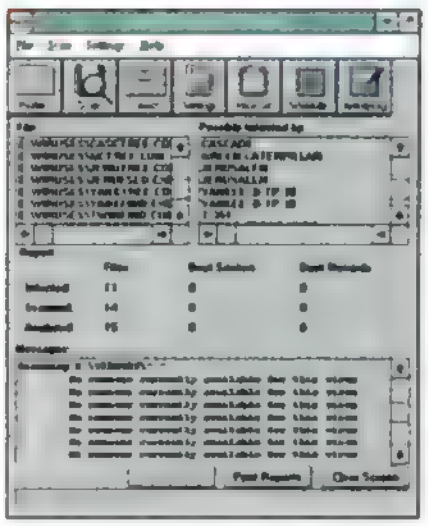
With this version, McAfee has integrated the program's familiar Clean utility into VirusScan's DOS-based Scan and Windows-based WScan sections. The result is that in a single operation, you can scan for viruses and clean up any infections that might be found or delete those files that couldn't be disinfected. However, VirusScan emphasizes detection over disinfection. In testing, it was able to find most of the sample viruses we used, but once it had detected them, VirusScan was unable to disinfect many.

To detect insidious encrypted and polymorphic viruses, VirusScan uses several detection techniques, including disassembly and simulated execution, signature checking, and file validation. Virus detection data is maintained separately from the scanning engine, making it easier to update the database with new virus patterns. The package includes Software Express, a communications program to download updated virus information from McAfee's bulletin board.

VirusScan also runs more efficiently. The combined scan-and-clean routine is much faster than previous releases, although you can expect the Windows version to run a little slower than its DOS counterpart. And VShield—an active TSR monitor that checks every program before allowing it to run—can now operate in extended memory to save precious conventional memory. We ran VShield and tried to decompress a compressed .ZIP file containing a dozen viruses; VShield caught all but one during decompression. VirusScan's VShield can also optionally detect polymorphic viruses, but we found that this feature cannot be used when checking executable files.

VirusScan's virus catalog module is extensive, listing thousands of viruses, but fails to display behavioral details for more than 100 of them. Don't be alarmed; the virus detection code has access to all the necessary details, and the list used for display purposes is gradually being completed.

VirusScan 2.1 is a modern Windows program, and it has user-friendly features such as drag-and-drop, toolbars, and tabbed dialog boxes, but its interface is clearly a first attempt. The tabbed configuration dialog can take forever to change pages, for example, and the virus list dialog may confuse you with its display-only check boxes. Nonetheless, the program's menu-based interface does succeed in taming the unruly horde of command-line switches while retaining VirusScan's unquestioned integrity.



WINDOWS DISINFECTANT: *VirusScan 2.1 has a modern Windows interface complete with toolbar and multipage dialog boxes.*

► **VirusScan, 2.1.** List price: *$129.99; site-license available.* Requires: *1MB RAM, Microsoft Windows 3.1 or later.* McAfee Inc., *Santa Clara, California; 408-988-3832; fax, 408-970-9727.*

Circle 428 on reader service card

■ Mapping

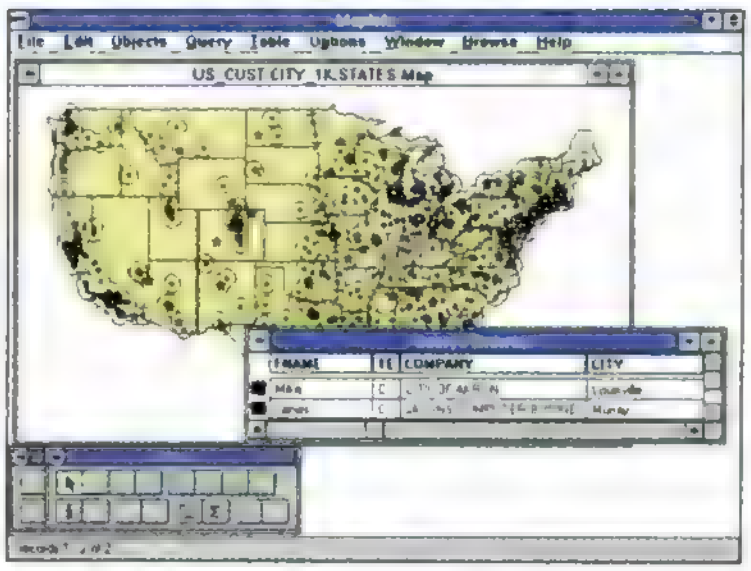
MapInfo: Geo-Centric Data

BY BRUCE BROWN

If raw numbers on a spreadsheet don't adequately show the relationship between sales performance and your company's different regions, or can't show how far your customers have to travel for service, you may be a good prospect for MapInfo Corp.'s $1,295 desktop mapping program, MapInfo 3.0 for Windows. This geo-centric data-integration and analysis tool is the most complete mapping program we've seen, as well as the best for organizing and presenting geographical data.

With MapInfo for Windows, you can display data by color-coding sales regions to show who is buying what, or you can place small pie charts to show income distribution by county. The presentation possibilities are nearly limitless. MapInfo lets you zoom in and out to show different levels of detail, as well as create and position labels and graphics in a separate, editable, cosmetic layer.

You can use your own data with MapInfo, as well as optional geographic, political, and demographic data sets. The program lets you create maps in its own file format or by using data from dBASE files. MapInfo can read delimited ASCII; Lotus 1-2-3, Release 3.0; and Microsoft Excel 4.0; and it can import the most popular raster graphics file formats. Programmers can automate MapInfo applications with the MapBasic Development Environment for Windows, which is available for $795.



SEARCH: *MapInfo's Browser window can be used to display data within selected areas.*

With SQL query support built-in, MapInfo lets you create a browser window to pull in data from multiple files; open files, views, graphics, and queries can be saved as workspace files for easy future reference.

MapInfo one-ups the current slew of street map and route-planning programs by graphically representing geographic information from a variety of sources. The program is used by such institutions as the Federal Emergency Management Agency, the New York City Police Department, and Fidelity Investments, but with its Windows interface and data integration tools, MapInfo 3.0 for Windows is just as appropriate for smaller organizations that need to track and present location-specific data.

► **MapInfo 3.0 for Windows.** List price: *$1,295; upgrade, $299.* Requires: *4MB RAM (8MB recommended), 4.5MB hard disk space, Microsoft Windows 3.1 or later.* MapInfo Corp., *Troy, New York; 800-327-8627, 518-285-6000; fax, 518-285 6060.*

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CIRCLE 389 ON READER SERVICE CARD

Electronic Publishing

InContext Makes SGML Documents as Easy as Paper

BY JAMES KARNEY

XSoft's $995 InContext 2.0 answers a real need for an easy-to-use software package that takes advantage of the Standard Generalized Markup Language (SGML) for producing electronic documents.

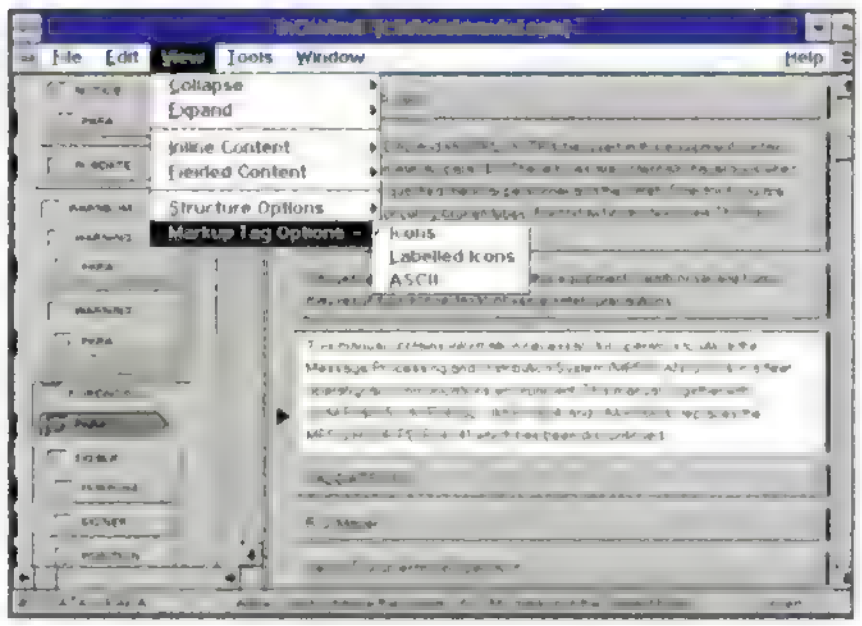
InContext allows relative novices to create and edit SGML files much as they would with a traditional word processor, and makes the process of putting together an electronic document as easy as if it were printed on paper.

SGML eases the movement of digital compound documents between different programs and computer systems, and has become the lingua franca of electronic publishing. It uses a tagging system to identify the structure and content of a document.Some of the entities that are already using SGML include the Air Transport Association and the Environmental Protection Agency; eventually, SGML may become the preferred method for moving documents over the Internet.

All of the rules for organizing and using elements within a document are contained within a Document Type Definition (DTD), which is an ASCII file that specifies the elements of a document and the order in which they are to appear. The major obstacle to widespread implementation of SGML has been the lack of a simple editing tool. InContext goes beyond meeting that need and now stands as the SGML program to beat.

SPLIT PERSONALITY

InContext has a dual-editing capability that letss users scan, modify, and navigate within any SGML document. The designers of the program assume that users will have at least a general knowledge of how structured documents are created and used, how the SGML tags work, and what a DTD is. Despite good help and tutorial sections, InContext is a powerful tool that requires at least this base level of understanding; without it you could get lost quickly.



PUBLISH: *InContext's interface allows editing of SGML documents and navigation among its various elements.*

One of InContext's strengths is its easy-to-use interface, which has two distinct areas of focus: The Logical Editor controls the formatting and flow of the elements that will be published in the SGML document, and the Content Editor is for the actual words and graphical elements. Together, these two editors control both the outline of what appears where and the specific characters and graphical elements used. InContext includes the Adobe Acrobat Reader, which enhances its ability to use electronic documents.

The Logical Editor sits on the left side of the screen and displays the document structure based on the tags defined in the DTD. It is also used to add new elements or modify the structure of an SGML document file. Each element is listed on a separate line in a box. While there are many similarities to a traditional word processor, you cannot just hit the return key to start a new paragraph; however, clicking on an element selects the related text and allows it to be edited.

The right side of InContext's screen contains the Content Editor, which is used to modify the actual text of your document. You can cut, copy, and paste among elements and other Windows applications. It offers spell- and grammar-checking, as well as a thesaurus.

ADVANCED SGML TECHNIQUES

InContext can handle some of SGML's more advanced techniques, such as the definition of attributes and creating entity references. While you are working, the program displays information about elements, such as the type of data they contain and the relationship of each element to the whole document. This type of information is the stock-in-trade of advanced SGML work, and XSoft's InContext does a credible job of handling these important tasks.

To give InContext a good workout, we imported several large SGML documents into the program. We were able to navigate through each one easily and found InContext an intuitive and straightforward way to modify just about every element. External figures created in Windows-based graphics programs such as CorelDRAW and Photo- shop were inserted using the Windows OLE function. Clicking on the displayed image opened the parent program and allowed us access to the original file.

SGML documents do not actually contain non-ASCII elements; you can only draw on them from external sources defined in the DTD protocol. This is a common limitation of basic SGML editing software, but InContext does an adequate—if awkward—job of handling it within Windows. For example, tables are handled using Microsoft Excel as an editor. First, you place a table element within your document, then you click on the Content Editor. Excel opens, and you can modify the worksheet directly. The finished table is linked to your SGML document.

All told, we found InContext a breath of fresh air. It is a flexible SGML editor that values ease of use. If your organization is contemplating an SGML system, InContext is worthy of serious consideration as a general-purpose editor.

▶ **InContext 2.0.** List price: *$995.* Requires: *8MB RAM, 6MB disk space, Microsoft Windows 3.1 or later; Excel 4.0 or later necessary for table editing.* XSoft (A division of Xerox Corp.), *Palo Alto, California; 800-428-2995; 415-424-0111; fax, 415-813-7162.*

Circle 403 on reader service card

FIRST LOOKS PLUS

From December 12 through 16, you can go on-line to download a demo of XSoft's InContext or discuss the program with *PC Magazine* reviewer James Karney; Robert Arn, president and CEO, XSoft; David Turner, InContext product manager; and Bradlee Chang, general manager, publishing products, XSoft. Type GO EXEC at any CompuServe ! prompt.

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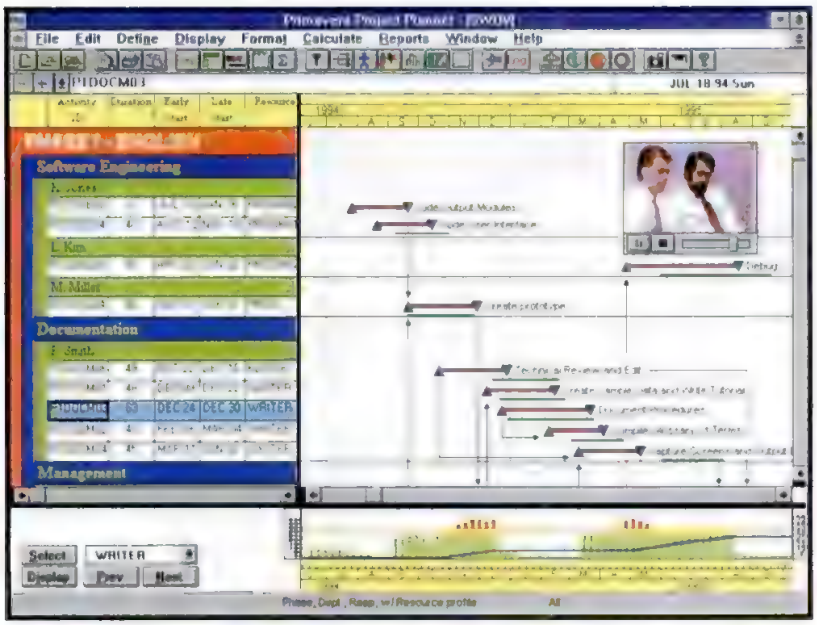

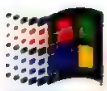

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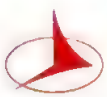

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CIRCLE 148 ON READER SERVICE CARD

■ Windows Utilities

Two Uninstallers That Help Clean Up After Windows

BY DAVID HASKIN

Windows applications are messy beasts, scattering files and other flotsam throughout your hard disk. Landmark's Uninstall-it and IMSI's WinDelete cost less than $50 each and can reclaim wasted disk space by removing Windows applications and systematically deleting scattered elements that applications leave behind. WinDelete is easier to use, but Uninstall-it more aggressively finds and eliminates the remains of applications.

SEEK AND DESTROY

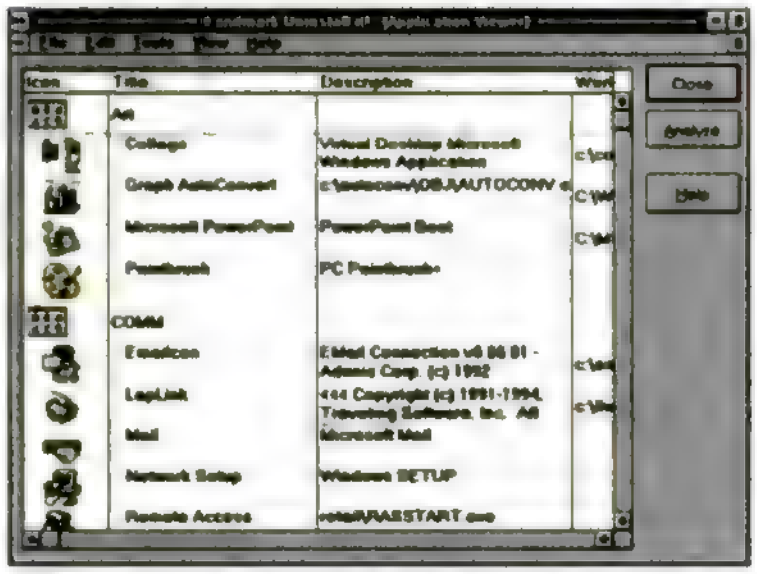
Both programs installed fairly easily, but be warned: WinDelete loads only from the Windows Program Manager, refusing to load from alternative shells such as PC Tools for Windows. Uninstall-it, however, works with The Norton Desktop and PC Tools for Windows, recognizing folders created in those shells as program groups.

After scanning your PC's hard disk, both products display lists of the programs they found and related items, such as DLLs, freestanding .INI files, and associations created by the application that are listed in your system's WIN.INI, SYSTEM.INI, and REG.DAT files. WinDelete lists program groups in the left window of a File Manager-like interface, showing specific applications as subgroups. If you click on an application, WinDelete displays the files and other items related to the program in the right window. By contrast, Uninstall-it lists all applications and related items in a single window, which makes for a more cluttered interface. In either case, you highlight the specific files and items to delete or click on a button to automatically remove them.

Besides a more self-evident interface, WinDelete also provides a module for installing Windows programs that tracks the location of program elements, making it easier for WinDelete to completely remove the program later on. However, we found that WinDelete occasionally neglected to delete files the application placed in Windows' directories. If you don't use WinDelete's installation module, the program can be lackadaisical about finding items to uninstall. For example, it only suggests deleting .INI and other files in Windows' directories that have the identical filename as the program's primary executable file. IMSI considers this a safety feature that prevents you from inadvertently deleting DLLs or .INI files shared with other programs, but this approach can prove timid at times. For example, when removing Microsoft Word for Windows, Version 6.0, WinDelete did not delete the WINWORD6.INI file because the name of that file is different from the program's main executable file, WINWORD.EXE.

By contrast, Uninstall-it systematically examines executable files and DLLs in the application's subdirectory to find related files located in other directories. The program examines related DLLs found in other directories to determine whether they are shared by other applications, and keeps an internal list of commonly shared DLLs. If it finds a shared DLL or if the DLL is on the internal list, Uninstall-it recommends against deleting it.

UPDATE: *WinDelete's program installation module examines your system and tracks the files each program installs and alters.*



TRIM: *Uninstall-it examines your desktop groups and tells you which programs it can completely delete.*

VIRTUAL DANGER

The Uninstall-it method is not foolproof, however, particularly if you use a virtual-desktop utility like the one included with PC Tools for Windows. This is because Uninstall-it looks only for DLLs shared by programs on your current virtual desktop, not programs located on other virtual desktops. If a program sharing a DLL is on another virtual desktop and the name of the DLL isn't known to Uninstall-it, you will receive no cautions about deleting it. But Uninstall-it can back up these files in a compressed format before deletion, saving them from oblivion.

Uninstall-it also does a good job of tracking down strays, such as WIN.INI sections and file associations that are unrelated to currently installed programs. However, it can't provide much information about the program to which the strays were related. Uninstall-it displays text strings from within the stray item, such as an internal REG.DAT entry. This, however, often isn't very descriptive. Missing from Uninstall-it is the ability—found in the competing UnInstaller, from MicroHelp—to locate unnecessary Windows system files. These could include font files or files needed only for running Windows in Standard mode. Such files may be left over if you upgraded from Windows 3.1 to Windows for Workgroups, which operates only in Enhanced mode.

If simplicity is more important than thoroughness, WinDelete is a safe choice that yields lots of disk space. However, Uninstall-it is much more adept at cleaning up after deleted Windows programs and helps ensure that unnecessary files and information don't steal precious hard disk space.

▶ **Uninstall-it.** Estimated selling price: *$49.* Requires: *4MB RAM, Microsoft Windows 3.1 or later.* Landmark Research International Corp., *Clearwater, Florida; 800-683-6696, 813-443-1331; fax, 813-443-6603.*

Circle 425 on reader service card

▶ **WinDelete.** List price: *$49.95.* Requires: *4MB RAM, 2MB hard disk space, Microsoft Windows 3.1 or later.* IMSI, *San Rafael, California; 800-833-8082, 415-454-7101; fax, 415-454-8901.*

Circle 426 on reader service card

■ Portables

Subnotebooks from HP And ZEOS Raise Hopes

BY BEN GOTTESMAN AND MELISSA J. PERENSON

Without a doubt, the first several generations of subnotebooks have yielded more disappointments than pleasant surprises. Most were too heavy, had poor battery life, and could not keep up with their slightly larger notebook cousins. Two new subnotebooks from Hewlett Packard and ZEOS, however, raise hopes once again. The HP OmniBook 600 is every bit as sleek as the original OmniBook, but adds a backlit passive-matrix color screen and the power of a 75-MHz DX4 processor. By contrast, the ZEOS Meridian is built around a smaller screen, but pushes a subnotebook's abilities to new heights.

HP OMNIBOOK 600

The HP OmniBook has matured significantly since it was first introduced, but appears much as the original OmniBook did. Still present are the comfortable, full-size keyboard and pop-out mouse, all

All OmniBooks come with standard serial and parallel ports, an infrared port, and an external VGA port. An external 3.5-inch floppy disk drive—an option on earlier OmniBooks—is now standard.

The latest OmniBook pays a price for its improvements in terms of battery life. The system's nickel hydride batteries lasted just over 1.5 hours on our WinDrain battery test, which presents a worst-case scenario of power use: The system is continuously in use and power conservation is turned off during testing. In actual usage, with HP's

LIGHT LOAD: *The OmniBook 600 combines power and color in a 3.9-pound package.*

masterpiece that minimizes compromises.

ZEOS MERIDIAN 400

The ZEOS Meridian 400 is a viable option for those users who want the pinnacle of subnotebook performance and are willing to live with a few tradeoffs.

The $3,095 Meridian 400 we tested came equipped with a DX4/100 processor, 8MB RAM, and a 350MB hard disk. The system measures 10.2 by 7.8 by 1.7 inches and weighs 4 pounds (it has a travel weight of 5.8 pounds). The floppy disk drive is external. A conveniently placed button enables a sleep mode, which is especially useful considering that the nickel hydride battery lasted for only 1 hour 22 minutes on our WinDrain battery test.

The 256-color passive-matrix display is a compromise as well. The screen isn't as crisp as it could be, and the 7.8-inch screen often seems cramped. Meridians with active-matrix and monochrome screens are also available.

You won't need to compro-

hand, the TruePoint pointing stick is imprecise and difficult to maneuver; its actuation buttons are awkwardly positioned, and it can be frustrating to use.

The strength of the Meridian 400 lies in its performance, which was comparable across the board to that of other

HIGH PERFORMANCE: *The ZEOS Meridian 400 packs a 100-MHz 486DX4 into a small, light case.*

DX4/100 units. The machine's Winstone 95 result surpassed other DX4/100 subnotebooks and notebooks we tested.

The Zeos Meridian 400 is a utilitarian machine for those seeking a combination of high performance and light weight.

▶ **HP OmniBook 600.** Estimated street price: *With DX4/75 CPU, 16MB RAM, 170MB hard disk, 8.4-inch color display, $3,199.* Hewlett-Packard Co., *Santa Clara, California; 800-443-1254, 503-757-2000.*

Circle 432 on reader service card

▶ **ZEOS Meridian 400.** List Price: *With DX4/100 CPU,*

■ **Personal Information Management**

Expresso: The Fun Side of Organizing Your Life

BY DAVID HASKIN

Expresso Calendar and Address Book is a personal information manager (PIM) that purposely places fun and simplicity before power. While its PIM capabilities are fairly standard, Berkeley Systems, the company that put a bizarre twist on screen-saver software, has focused on integration and appearance, making this $49 package fun and easy to use.

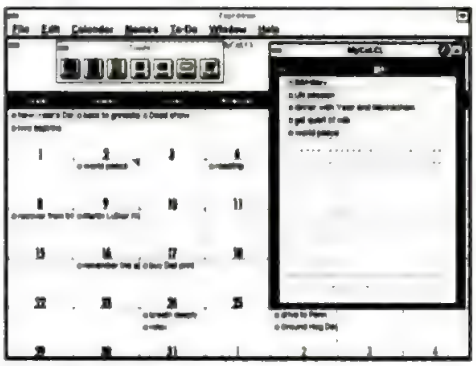
Expresso's greatest drawing card is the way it interacts with Windows. The program places a special FlashBack icon in the title bar of other applications. When you click on this icon, Expresso instantly appears on-screen. When viewing Expresso, you can click on the FlashBack icon and turn Expresso's on-screen elements into your Windows wallpaper. This presents your PIM information as a traditional desktop calendar, but no changes are allowed unless you recall Expresso. You can return to your normal wallpaper by maximizing the Expresso icon.

Adding information to Expresso's calendar, to-do list, or address book is simple. Rather than navigating dialog boxes, just click on the module and type the information in a text box. The calendar module assumes that if you start a text entry with a number, it refers to the time of day. This makes routine entries a one-click affair, and the ability to drag items from one module to another eliminates needless repetition.

Changing a calendar entry for a meeting or conference call is accomplished by double-clicking on it to display a dialog box. In that dialog box, you can schedule alarms and recurring meetings; you can also change meeting times and durations. Unfortunately, Expresso can't check for scheduling conflicts.

One of the most important features of Expresso that we found during testing was the program's to-do list, which lets you set both priorities and status icons, such as whether you delegated the item or whether it is in progress. You can sort the to-do list on the basis of priority, status, or due date, but Expresso's sorting capabilities stop there. You can't accomplish more sophisticated sorting, such as listing items with a specific priority that are due on a specific day.

The address book is straightforward and functional, but not as power-packed as other PIMs' address books. While Expresso can import delimited text files and data from a variety of entry-level PIMs, it can't import dBASE or other database files. Also, there's no uninstall utility included.



CAMOUFLAGE: *Expresso can blend into your Windows environment by turning its PIM elements into wallpaper.*

Expresso isn't for people who depend on powerful PIMs to run their lives. Rather, it's a well-priced program that is a fun and reasonably complete alternative for those who need only basic scheduling and list-keeping capabilities.

▶ **Expresso Calendar and Address Book.** List price: *$49.* Requires: *4MB RAM, 8MB hard disk space, Microsoft Windows 3.1 or later.* Berkeley Systems Inc., *Berkeley, California; 800-344-5541, 510-540-5535.*

Circle 423 on reader service card

■ **PCMCIA**

PocketFile 260: Data to Go

BY MARINO DELZOTTO

Intégral Peripherals has done more than break through the current PCMCIA hard disk capacity barrier with its PocketFile 260 hard disk card. This 260MB Type III PCMCIA card can hold roughly 50 percent more data than the next-closest PCMCIA hard disk card, and its design helps to ensure that your data will be safe. The PocketFile's estimated cost of $479 is a small price to pay for additional notebook storage capacity and security.

Intégral is revolutionizing the PCMCIA hard drive paradigm with its patented MicroGlide and dynamic head loading technologies. MicroGlide technology uses polished media, allowing the heads to fly closer to the disk surface, which increases data density and thereby produces higher storage capacity. Dynamic head loading parks the heads off the disk when they are not in use, giving the drive a shock-resistance level of 750g. Most disks park the head in the middle of the disk when the drive is not in use, thus increasing the chance of damaging the disk and losing data.

In our testing of the two-disk, four-head PocketFile 260, we found its performance to be on a par with other PCMCIA cards; data throughput using PC Bench, Version 9.0, and WinBench 95, Version 1.0, was 105 kilobytes per second under DOS and 93.0 KBps under Windows. The only problem was that the card tended to heat up after prolonged use.

The PocketFile PCMCIA disk can be used in conjunction with Interlink and hard disk utilities such as SmartDrive or Defrag. In essence, your notebook or desktop PC treats the card as if it were a native hard disk. The Intégral PCMCIA hard disk comes with easy to install drivers and is compatible with most PCMCIA generic hard disk drivers. It loaded successfully and operated without any problems on several different notebook computers. One major drawback to this device, however, is its inability to be used with Windows' virtual memory.

While more expensive than the typical notebook hard disk, the 3-ounce, 260MB PocketFile 260 PCMCIA hard disk is an excellent way to give your data a home while you're on the road.

UPGRADE: *Intégral's disk-on-a-card lets you increase your notebook's storage capacity by 260MB.*

▶ **PocketFile 260.** Estimated street price: *$479.* Requires: *Type III PCMCIA slot.* Intégral Peripherals, *Boulder, Colorado; 800-333-8009, 303-449-8009; fax, 303-449-8089.*

Circle 424 on reader service card

Spreadsheets

FuziCalc: For when the World *Isn't* Black and White

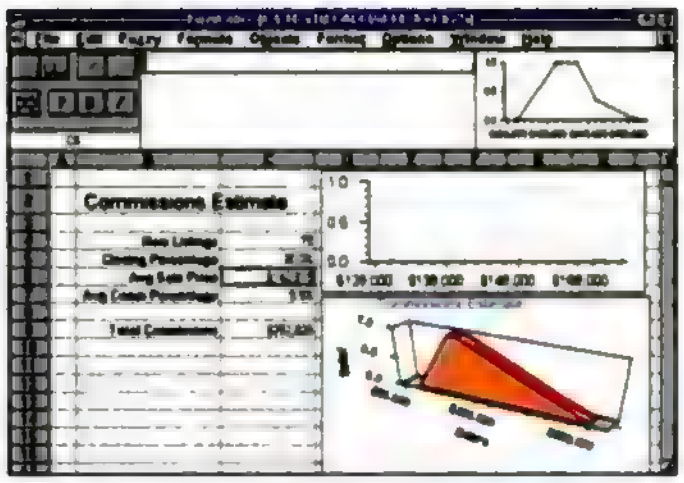
BY STEVE ROSENTHAL

Have you heard the joke about the statistician who drowned fording a river with an average depth of 3 feet? That type of unfortunate information leveling probably won't happen to your spreadsheet calculations if you use FuziCalc, Version 1.5. Rather than limiting spreadsheet cell values to single numbers, this $199 Windows spreadsheet works with a range of possible values, allowing FuziCalc to deal with the gray areas of business forecasting.

For example, if you're estimating next year's business income, you don't have to start with a single estimate; you can enter a range of possible sales values and prices. FuziCalc uses a belief graph that is carried through to all derived cells. To represent a fuzzy value, you can type in a single value and let the program provide a default range of plus or minus 10 percent, or you can enter an explicit range of values. Similarly, the program lets you select from five different belief graphs that describe your confidence in each outcome, including a triangle, a double peak, a tent shape, and two others; the default distribution is a triangle with its central value a belief value of 1 and its range endpoints a belief value of zero.

As a spreadsheet, our experience is that FuziCalc takes care of the basics but not much more. You can choose from 65 logical and arithmetic functions, along with 27 special fuzzy functions and a multitude of graphing styles. But we found that there are no macros, only SYLK importing (you have to convert Lotus .WKS and .WK1 files), and very few automation features. FuziCalc does not supply an explicit consolidation function, but you can open multiple spreadsheets using the Windows Multiple Document Interface (MDI) and create DDE links between individual cells. If you'd rather use a more sophisticated graphing package, FuziCalc can act as a DDE source or client.

The FuziCalc package includes a 300-page manual that explains every detail of the program. However, there is no discussion of fuzzy theory, and you won't find any guidance about when to use fuzzy numbers or what operations can be applied to fuzzy numbers without losing meaning. In other words, unless you're well versed in number theory, you wouldn't want to do a lot of calcuations within FuziCalc.



GRAY AREAS: *FuziCalc works well in areas where you can't reduce an estimate to a single number.*

We found that FuziCalc is best used for quick analysis and presentation of real-world values. Even though it lacks many features found on more traditional spreadsheet programs, it is a useful tool when you can't reduce a value to a single number.

▶ **FuziCalc, Version 1.5.** List Price: *$199.* Requires: *4MB RAM, Microsoft Windows 3.1 or later.* FuziWare Inc., *Knoxville, Tennesee; 800-472-6183.*

Circle 429 on reader service card

Portfolio Management

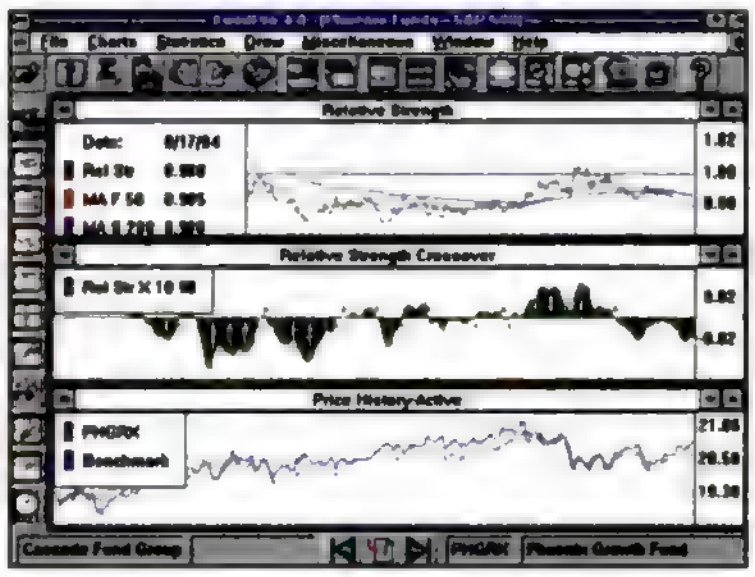
FundPro Provides Answers For the Weary Investor

BY CHRIS SHIPLEY

What can an investor get for $249? A couple of shares in a blue chip company? A handful of shares of Wall Street's current favorite? On the other hand, $249 invested in FundPro for Windows—an information-packed mutual fund advisor with links to electronic quote updates—just might pay a better return.

Be warned: This program isn't for investment wallflowers or the faint of heart. It's for active mutual fund investors—people who manage their own portfolios or retirement funds. FundPro provides megabytes of high-quality comparative data, analytic charts, and daily price updates on some 900 no-load and low-load mutual funds.

To keep this data current, FundPro includes a communications module that uses your PC's modem to dial into Manhattan Analytics' up-to-date mutual fund database. It is a useful feature that makes getting the latest prices convenient. The program automatically updates the database to keep track of capital gains distributions—a potential headache for fund investors at tax time. The on-line information costs $20 per month or $240 per year.



ANALYZE: *FundPro's charts of historical and present-day data make fund performance graphically clear over time.*

As jam-packed with historical data as FundPro is, the clean interface and tutorial make the program a snap to use. Sure, you can get lost for hours in the data, charts, and analysis tools, but it's more likely you'll be spending your time exploring the many investment options, not trying to wade through a hard to understand program. FundPro always makes it clear where you are and what you can do next—if you're a knowledgeable investor.

We found that the only thing FundPro lacks is background on the fund analysis techniques the program employs. This makes FundPro an inappropriate choice for new or casual investors, who are likely to get lost in the program's depth of information. They might be better served by an investment program like Reuter's Money Network, which provides an introduction to the world of mutual funds along with specific investment recommendations.

Active investors, on the other hand, will have a field day with FundPro, and may receive a payback larger than the program's $249 cost.

▶ **FundPro for Windows, Version 3.0.** List price: *$249; on-line fund updates, $20 per month.* Requires: *4MB RAM, 15MB hard disk space, Microsoft Windows 3.1 or later, 2,400-bps (or faster) modem for on-line updates.* Manhattan Analytics Inc., *Manhattan Beach, California; 800-251-3863, 310-374-2142; fax, 310-374-3142.*

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■ Personal Finance

Quicken 4 for Windows: One-Stop Money Manager

BY GREGG KEIZER

Quicken 4 for Windows ($39.99), the latest in Intuit's line of money managers, covers the gamut of personal finance functions from electronic bill-paying and investment tracking to budget building and future cash forecasting. The only question that remains is how Quicken and the rest of Intuit will be integrated into the Microsoft software empire following the $1.5 billion purchase.

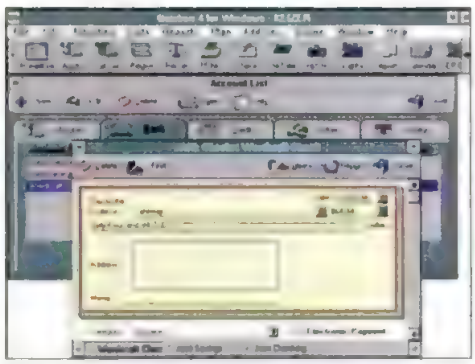
Along with the latest release of Quicken for DOS, Quicken for Windows comes in a variety of formats: the basic Quicken 4 for Windows, and Quicken Deluxe 4 for Windows ($59.99), which adds portions of Intuit's Home Companion. Each variation features a different mix of peripheral tools and services, and the Windows versions come on either a CD-ROM or floppy disks. Even before you leave the store, you may be confused.

SAME BASE, MORE VARIETY

Fortunately, all of the versions share the same core and make basic check writing a breeze. Quicken hasn't deviated from its popular checkbook metaphor, but accounts are now grouped by file-folder-style tabs, so that a mouse click displays just the credit-card accounts, for instance.

With its installation and interface changes, Quicken 4 holds first-time users' hands more firmly. During setup, Quicken conducts an interview, asking questions and using the responses to build a financial profile. And HomeBase—a new menu that groups tools and tasks in broad categories such as Day-to-Day and Planning—can be used to launch the most common financial chores.

Quicken's budgeting, reporting, and charting capabilities show some minor improvements in this latest release. You can now group budget categories into more general super-categories—Dining and Groceries under the broader Food group, for instance. The forecasting function, though not strictly part of the budget process, uses its information to draw conclusions about future net worth and account balances.



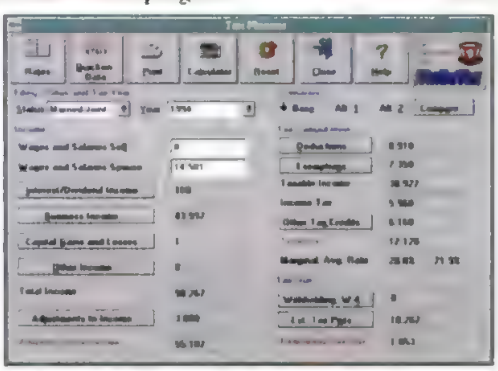
FIND: *Quicken includes tabbed account groupings and one-click access to accounts from the checkbook or register.*

A new Snapshot displays as many as six miniature charts and reports simultaneously for an instant across-the-board look at your financial status. You can still drill down to the transaction level from reports and charts to view the underlying data, create a report from any transaction, and customize existing reports or charts.

To keep track of your investment portfolio, Quicken can connect to Intuit's on-line financial service, which costs $2.95 per month for six updates. Additional updates are 50 cents each. You can still track multiple investment accounts and view your holdings in the convenient Portfolio window. Unlike MECA Software's Managing Your Money for Windows program, however, Quicken doesn't let you set alarms at minimum and maximum price quotes.

PLAN AND SAVE

Quicken 4's most significant addition is the Tax Planner, a tax-liability estimator with a "what-if" worksheet to flesh out various scenarios. While not quite as flexible or comprehensive as the tax planning capabilities of Managing Your Money, Tax Planner shows a bottom-line tax bill. Quicken Deluxe adds Tax Link Assistant, which lets you make quick global changes to the relationships between categories and specific IRS forms and schedules. This feature is helpful both for reporting purposes and for preparing data prior to importing it into a tax preparation program.



TAX PLAN: *Quicken's Tax Planner uses existing data to forecast your year-end liability.*

TAX CONNECTION

Users of TurboTax (from Chipsoft, which was acquired by Intuit) may want to consider upgrading that package to Quicken 4 for Windows, since the two programs can now be dynamically linked from within the 1994 version of Intuit's TurboTax.

Other extras include electronic bill-paying through the CheckFree service, access to an electronic credit-card statement via a special VISA card (which now offers free downloadable statements) and an intriguing new savings goal planner that "hides" money you're saving for a major purchase.

Even with all of its additions and enhancements, Quicken 4 marks only evolutionary changes from the previous version. If you've already added Home Companion to Quicken 3 for Windows, for instance, you have the basic pieces of Quicken 4. Of the four variations, Quicken 4 Deluxe for Windows on CD-ROM is the most compelling. Its multimedia financial advice and excellent mutual fund guide give it enough extra punch to justify its higher cost.

It may not be a great step forward, but Quicken 4 for Windows still leads the way. Regardless of the name on the package—Intuit or Microsoft—this program remains the best all-around money manager for the PC.

▶ **Quicken 4 for Windows.** Estimated street price: *$39.99.* Requires: *4MB RAM, 8MB hard disk space; for CD-ROM version: 8MB RAM, 12MB hard disk space.* **Quicken Deluxe 4 for Windows.** List price: *$59.99.* Requires: *4MB RAM, 12MB hard disk space; for CD-ROM version: 8MB RAM, 22MB hard disk space. All packages require Microsoft Windows 3.1 or later.* Intuit Inc., *Menlo Park, California; 800-624-8742, 415-322-0573.*

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NEW dBASE 5.0 for Windows

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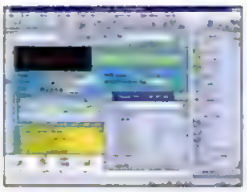

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■ Accounting

BusinessWorks Brings You Closer to Your Customers

BY ELLEN DEPASQUALE

With over 100 enhancements that promote better integration and easier reporting, BusinessWorks, Version 9.0, solidifies Manzanita Software's place as the leader in the midrange accounting software market. The $995 package is a flexible accounting system aimed at midsize companies trying to improve their bottom line while providing better customer service.

Manzanita bridges the platform gap by releasing DOS and Windows versions simultaneously. Both programs are based on modules for each accounting function, and are file compatible. Version 9.0 also utilizes a PC's expanded or extended memory to increase the speed of data access and searching.

FOLLOW-UP REMINDERS

By offering pop-up electronic notes for customers, vendors, inventory part numbers, and the like, BusinessWorks can perform some of the functions of a contact manager. The primary purpose of these pop-up notes is to remind sales or accounting personnel to make customer follow-up calls. While this feature is not a replacement for a full-fledged contact manager, it can enhance customer service as well as alert different users of BusinessWorks to important customer information.

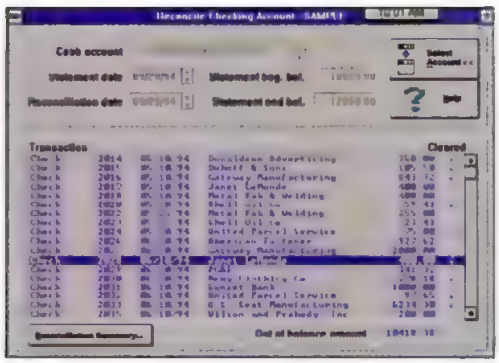
Information comes out of BusinessWorks as easily as it flows in because of improvements to the package's reporting capabilities. The General Ledger module produces date-sensitive income statements, over any period, and is not limited to monthly reports. The Accounts Payable module benefits from more detailed reports that ease the bank reconciliation process. The Accounts Receivable module benefits from additional reporting features, such as a payment analysis of how long each customer has historically taken to pay their bills.

Version 9.0 builds on BusinessWorks' outstanding Payroll module by offering warnings when employees exceed the allotted number of sick days or vacation days. The program also features better tracking and reporting of employee review dates. In addition, Manzanita has improved BusinessWorks' direct-deposit handling so that it is now easier to start and stop the direct deposit of pay for any employee.

The Inventory Control and Purchasing, Order Entry, and Job Costing modules are carried over to Version 9.0 from the previous version, and each is integrated seamlessly with the other modules. For example, the Inventory module now offers a new transfer parts option that simulates multiple warehouses. This type of information is essential to correctly balancing inventory with sales.

The Order Entry module can transform customer quotes into invoices without the need to re-enter the information; you can even generate quotes by copying them from one customer to another. Not only does this save time, it also promotes consistent quotes between salespeople.

Finally, the Job Costing module almost runs by itself. Once the job has been set up, the necessary information from all other modules posts directly into Job Costing. Everything from employee salary and payroll overhead to accounts payable and accounts receivable transactions are included to estimate costs.



TRACK: *By posting transactions as they occur, BusinessWorks keeps an up-to-date bank balance.*

STEP BY STEP

Each of the modules has plain-English menu options, but if you need assistance, the manuals are logical and easy to understand; there are even screenshots for each menu item. A sample of each report produced by the module can be found in the back of the manual so that you can quickly choose the reports that include the information you need.

BusinessWorks is an accrual-based accounting system that posts transactions in real time. When a transaction is saved, it is immediately posted directly to the related journals, such as Accounts Payable, Cash Disbursements, and General Ledger. Opinions are mixed as to the benefits of real-time posting versus batch posting (where the transactions are held until a later posting time). The advantage to accrual posting is that your reports and bank balances are always up-to-date. The disadvantage becomes apparent when you make a mistake: You may need to go through several steps to reverse or delete the transaction.

Correcting errors is a fairly simple procedure. The General Ledger offers a Void Journal Entry feature. Voided entries will not appear on Trial Balance and Journal Detail reports unless you choose to include them, but they remain in the system for the accountant's audit trail.

About the only thing BusinessWorks cannot do is foreign currency transactions, a curious deficiency in this age of international business.

BusinessWorks is a powerful and affordable accounting program for the midsize business. It offers enough flexibility and access to information to satisfy both the CEO and the CFO.

▶ **BusinessWorks, Version 9.0.** List price: *$995; additional nodes, $395 each.* Requires: *4MB RAM (8MB recommended), 5MB hard disk space per module, Microsoft Windows 3.1 or later.* Manzanita Software, *Roseville, California; 800-447-5700, 916-791-7730; fax, 916-791-5525.*

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LOGITECH

Simulation Software

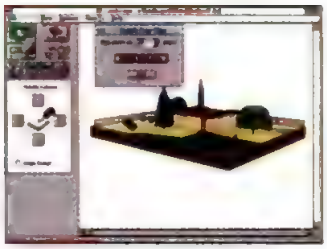
3D Landscape: PC Gardener

BY DANIEL GROTTA AND SALLY WIENER GROTTA

Corporate landscapers and suburban weekend warriors intent on sprucing up their surroundings would be well advised to consult 3D Landscape. It's a simple $50 program available on CD-ROM and 3.5-inch floppy disks that is excellent for planning almost any outdoor project.

The 3D Landscape package allows users—both do-it-yourselfers and landscape pros—to draw property lines and position existing buildings, trees and other objects before starting to place plants, design a deck, or grade a driveway. By consulting 3D Landscape's on-line how-to book, you'll get plenty of help in choosing and placing the right flora, estimating costs, buying supplies, and using the right tools. You can then observe your project taking shape with a bird's-eye view that is rotatable.

3D Landscape provides data on over 400 varieties of plants, bushes, and trees, including their size, how fast they grow, and whether they thrive in shade or direct sunlight. It even includes lists of manufacturers and vendors of specific supplies. By using the program's animated aging tool, you can see how everything will look during any month of the year or even 10, 20, or 50 years hence. A shading tool shows you how shadows will look at any hour of the day, any day of the year.



HOW WILL YOUR GARDEN GROW: *3D Landscape shows how your garden will look in the future.*

Before taking spade in hand, start up 3D Landscape.

▶ **3D Landscape.** Estimated street price: *$50.* Requires: *4MB RAM, 15MB hard disk space (5MB hard disk space for CD-ROM installation), Microsoft Windows 3.1 or later.* Books That Work, *Palo Alto, California; 800-242-4546, 415-843-4400.*

Circle 438 on reader service card

Windows Applications

Scientific WorkPlace: Where Words and Equations Meet

BY BARRY SIMON

TCI Software's $595 Scientific WorkPlace 2.0 combines a word processor and a mathematical scratch pad to handle the confluence of words and complex equations. It is an excellent program for preparing scientific and technical papers.

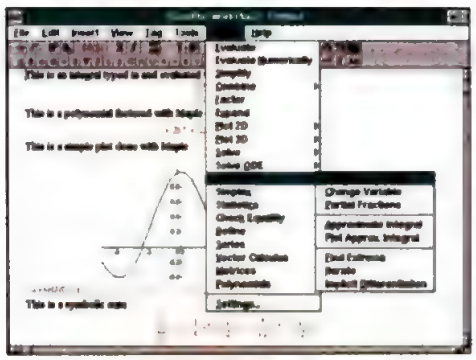
Based on the Maple symbolic math engine, Scientific WorkPlace uses natural symbol notation for mathematical input. Most competing products build equations from a highly stylized language with strict rules of syntax. The Maple engine also solves ordinary differential equations and can display both two- and three-dimensional graphs.

The closest product to Scientific WorkPlace is MathCAD, which also uses natural symbols for input. But MathCAD is more suited for playing out mathematical what-if scenarios; the inclusion of Scientific Word, a capable word processor, and extensive graphing capabilities make Scientific WorkPlace more attuned to the technical writer.

We encountered a few disappointments while testing Scientific WorkPlace. You can edit only one document at a time, and the only undo is for deletions.

MathCAD has long dominated the mathematical scratch pad market, but it now has a serious competitor in Scientific WorkPlace.

▶ **Scientific WorkPlace 2.0.** List price: *$595; academic price, $495; upgrade from Scientific Word, Version 1.0 or 1.1, $199.* Requires: *8MB RAM, 30MB hard disk space, Microsoft Windows 3.1 or later.* TCI Software Research, *Las Cruces, New Mexico; 800-874-2383, 505-522-4600; fax, 505-522-0116.*



SOLVE: *Scientific Word and Scientific WorkPlace let you create and solve complicated mathematical expressions.*

Circle 430 on reader service card

Speakers

Wrap Yourself in Sound

BY TIN ALBANO

Without sound, multimedia computers are just PCs with CD-ROM drives. Most multimedia machines, however, come with low-powered speakers. With Sound Retrieval System (SRS) technology, Jazz Inc. hopes its $379.95 J-707s speakers bring multimedia computing into a new dimension filled with 3-D sound.

SRS technology creates three-dimensional sound images from standard stereo signals. With SRS, the 14-watt-per-channel J-707s speakers produced a high-quality, true-to-life sound far better than that of the majority of high-end speakers we've heard.

Though sound quality is important when choosing speakers, you should also take speaker design into consideration. This is where the J-707s speakers falter. The speakers are magnetically shielded so they won't upset and distort images on a PC's monitor, but they are too large to fit on your desk and the wood-grain finish seems out of place next to a PC. At present, the controls are all mounted on the back of one of the speakers, an inconvenience that Jazz says will be taken care of in the next crop of J-707s speakers.

SURROUND SOUND: *Jazz's J-707s speakers wrap multimedia applications in 3-D sound.*

Overall, the sound quality of the J-707s speakers was good, but Jazz should consider making them blend better into a PC environment.

▶ **Jazz J-707s.** List price: *$379.95.* Jazz Inc., *City of Industry, California; 818-336-2689; fax, 818-336-2489.*

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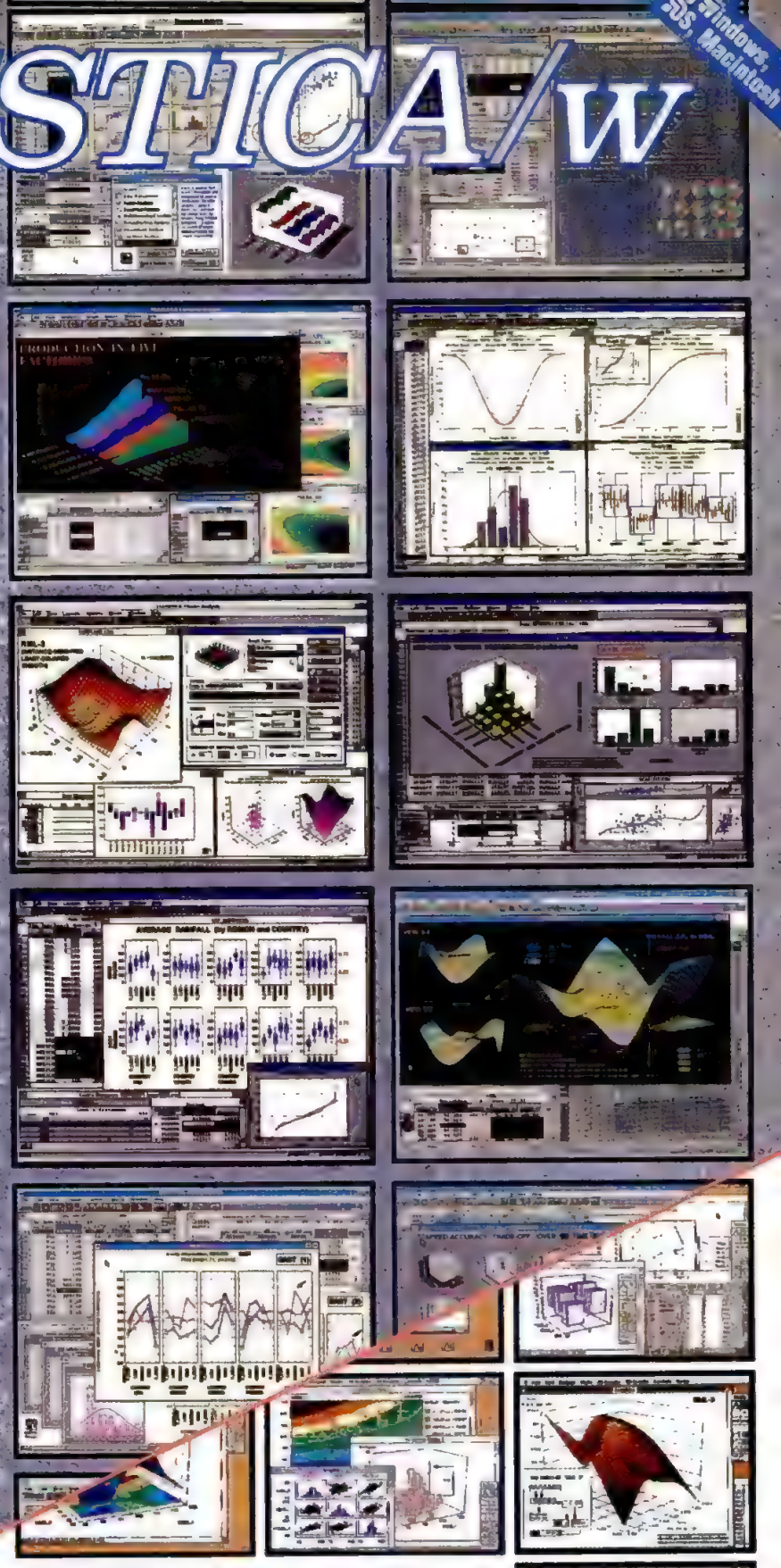
STATISTICA/w

Windows, DOS, Macintosh



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Multilevel Security Features	X	X	X
Asset tracking	X	X	X
PC tattooing	X	X	X
Optional Desktop Management Software	X	X	
Bi-directional parallel port	X	X	X
Desktop Management Interface (DMI)[2]	X	X	

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- *EPA Energy Star certified*
- *ISA Autoconfiguration utility (Plug-n-Play)*
- *Integrated Desktop Management Interface (DMI)[3]*
- *Free three-year limited warranty for parts and labor[2]*

from **$1,379†**

HP Vectra M2

- *Ultra VGA2 local-bus accelerated video supporting up to 1280 x 1024 resolution*
- *Optional integrated 10Base-T networking*
- *Systems Diagnostics Utility*
- *EPA Energy Star certified*
- *ISA Autoconfiguration utility (Plug-n-Play)*
- *Integrated Desktop Management Interface (DMI)[3]*
- *Free three-year limited warranty for parts and labor[2]*

from **$1,429†**

HP Vectra XM2

- *8-MB RAM, expandable to 96-MB*
- *PCI Integrated 64-bit S3 Vision-864 graphics accelerator supporting up to 1280 x 1024 resolution*
- *Optional PCI Integrated 32-bit 10Base-T networking*
- *Integrated Desktop Management Interface (DMI)[3]*
- *EPA Energy Star certified*
- *Free three-year limited warranty for parts and labor[2]*

from **$1,779†**

HP Vectra XU

- *Integrated 32-bit PCI SCSI-2 interface*
- *PCI integrated 64-bit S3 Vision-864 graphics with 1280 x 1024 resolution or PCI MGA Ultima Plus graphics with up to 1600 x 1200 resolution*
- *32-bit PCI IDE hard disk interface*
- *8 or 16 MB of RAM, expandable to 256 MB*
- *PCI Integrated 32-bit 10Base-T networking*
- *Integrated Desktop Management Interface (DMI)[3]*
- *Free three-year limited warranty for parts and labor[2]*

from **$3,279†**

intel inside

yes NetWare Tested and Approved

All HP Vectra PCs come with MS-DOS® 6.2 and MS Windows for Workgroups 3.11 pre-installed; HP mouse and keyboard included. *Feature included with some models. †U.S. list price, dealer prices may vary. Monitor not included. [1]Other capacities available. [2]First year on site, 24-hour service. Second and third year return to dealer. [3]Available 10/1/94. ‡With permission CRN/Benchmark. MS-DOS is a U.S. registered trademark and Windows is a trademark of Microsoft Corporation. Pentium and the Intel Inside logo are U.S. trademarks of Intel Corporation. PPG407 ©1994 Hewlett-Packard Company

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March 16 1993
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- Fingertip front-panel controls
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New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Jonathan Matzkin and Asa Somers

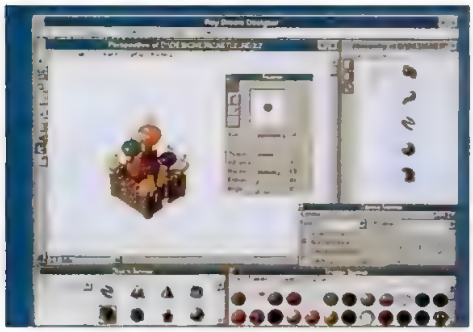
NEW

Ray Dream Designer 3 Debuts On PC Platform

Ray Dream has moved its popular Macintosh-based 3-D illustration software program to the Windows environment. Ray Dream Designer 3 for Windows provides advanced 3-D modeling and rendering capabilities, including Bezier tools, cross-platform compatibility, and more than 120 color and texture characteristics.

Ray Dream Designer's 3D Paint feature allows you to paint color directly onto a three-dimensional object. As you apply the color, it conforms to the geometry of the object, adopting any shading and reflection attributes that you have already placed there. The Shaders Browser utility contains a catalog of color and texture characteristics. Each shader includes channels that carry information on color, reflection, shininess, bumps, and other physical attributes.

You have unlimited lighting options, and Ray Dream Designer's virtual trackball allows you to rotate an object using a single mouse click. The program's Modeling Wizard gives first-time 3-D artists step-by-step guides to creating objects. Ray Dream Designer can import .CMG, CorelDRAW, FreeHand, Illustrator, and .WMF files, as well as texture maps created in .BMP, .PCX, Targa, and TIFF formats.



Choose from among more than 120 colors and textures in Ray Dream Designer's Shaders Browser.

▶ **Ray Dream Designer 3 for Windows.** List price: *$349.* Ray Dream Inc., *Mountain View, California; 800-846-0111, 415-960-0768; fax, 415-960-1198.*

Circle 410 on reader service card

HOT PROSPECT

Enter a Virtual World with i-glasses

A bulky helmet is no longer necessary for providing a virtual interface with a PC, thanks to **Virtual I/O**'s i-glasses. This 7-ounce device looks like a pair of reflective sunshades but actually contains two 0.7-inch color LCD screens, which create a large virtual display before your eyes. The unit also features fully adjustable stereo earphones.

Virtual I/O calls i-glasses a Personal Display System (PDS) because it is designed to provide a more private interface for such input sources as television, videotape, and most popular gaming systems. The $599 unit also supports 3-D viewing. While the basic model only gives audio and video output capabilities, an optional PC module ($200) adds head-tracking functionality and a PC converter. With the added module, i-glasses becomes an *input* device as well: You tilt and turn your head to change the view on-screen. You can play DOOM and other PC-based video games, perform a virtual walk-through of a CAD-designed space, or protect your private on-screen information if you are computing on a crowded airplane, for instance.

Virtual I/O also offers two other PDSs: the $399 Gamer!, designed specifically for gaming systems, and the UltraView 2020, for industrial and professional applications (price varies depending on configuration).

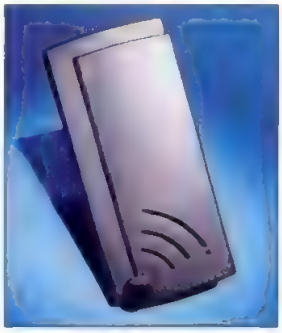
▶ **i-glasses.** List price: *$599; with PC module, $799.* Virtual I/O, *Seattle, Washington; 206-382-7410; fax, 206-382-8810.*

Circle 408 on reader service card

NEW

DECtalk Express Lets Your PC Talk Back to You

Digital Equipment Corp. has introduced the portable DECtalk Express Speech Synthesizer, a peripheral that converts ASCII text into spoken words. It is designed to aid computer users who are visually impaired or have learning disabilities. The unit weighs less than a pound and connects via the PC's serial port. The DECtalk features nine predefined voices (four male, four female, and one child), an adjustable speech rate (from 75 to 650 words per minute), and an integrated dictionary. You can specify whether you want text spoken or spelled out letter by letter, and you can have the DECtalk pronounce some, all, or none of a document's punctuation.



The DECtalk Express can speak quickly or can carefully spell out each word.

▶ **DECtalk Express Speech Synthesizer.** List price: *$1,195.* Digital Equipment Corp., *Maynard, Massachusetts; 800-344-4825.*

Circle 409 on reader service card

NEW

Charge It: On-Line Business Gets Protection

As increasing numbers of computer users explore the Internet and businesses begin offering expanded on-line services, security is becoming a critical issue. In particular, protecting credit-card information has traditionally been an obstacle to conducting sales on-line. The First Virtual Internet Payment System, from **First Virtual Holdings,** provides a secure on-line environment for buying and selling information (for details, see the Trends column in this issue). The service requires mer-

Photography by Thom O'Connor

chants only to have access to the Internet. First Virtual charges an initial registration fee to merchants and consumers and then offers its security services for a 2 percent commission on each transaction. If merchants do not own the hardware necessary to handle their sales directly, First Virtual provides the "First Virtual Infohaus," an electronic shopping mall where businesses can rent space to store and sell information. Consumers can point and click to browse electronic "aisles" for information on sale.

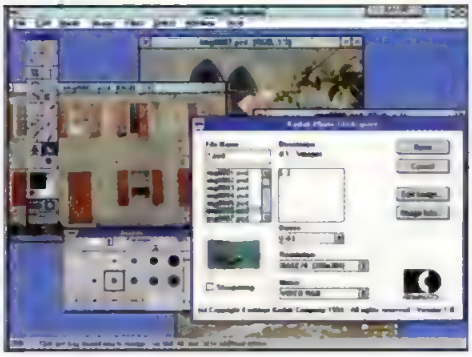
▶ **First Virtual Internet Payment System.** List price: *Initial registration fee: $10 for merchants, $2 for consumers; First Virtual receives a 2 percent commission on each transaction.* First Virtual Holdings Inc., *San Diego, California; 800-570-0003; fax, 619-234-9502.*

Circle 411 on reader service card

NEW

Kodak Software Pulls Photo CD Images into Photoshop

Because of the popularity of Photo CD–compatible CD-ROM drives, **Eastman Kodak Co.** has unveiled the Photo CD Acquire Module for Adobe Photoshop. Windows users



Importing Photo CD images into Photoshop is a snap with Kodak's new plug-in.

can select any available Photo CD resolution, crop images, and adjust brightness, saturation, and color balance before loading a Photo CD image as a Photoshop file. Kodak's software controls the selection of color and contrast in the native PhotoYCC image file format before importing the images into a Photoshop file. In addition to the default PhotoYCC-to-RGB video conversion, the Acquire module provides 21 other conversions.

▶ **Kodak Photo CD Acquire Module for Adobe Photoshop.** List price: *$59.95.* Eastman Kodak Co., *Rochester, New York; 800-235-6325.*

Circle 412 on reader service card

BRIEFS

SOFTWARE

FontMinder, Version 2.5, from **Ares Software Corp.** (pricing starts at $249.95 for two workstations) offers network administrators a way to control font use on a network level. FontMinder can individually set up workstations with a different mix of fonts, or you can create a "network core font library" of fonts and font packs managed by the administrator. 415-578-9090; fax, 415-378-8999

While it still has its familiar "notebook" user interface metaphor, Lotus Organizer has been upgraded with more than 100 new features. Version 2.0 ($149; upgrade, $49) from **Lotus Development Corp.** gives you new group-scheduling functionality when you use it with cc:Mail 2.*x* and Notes 3.*x*. When you schedule a meeting, Organizer can now retrieve individual names from the workgroup's or organization's cc:Mail directory or Notes Name & Address Book. The Lotus Organizer Scheduling Agent, an automated process, delivers meeting information to users and automatically updates meeting status and calendars. Organizer now lets you schedule overlapping planner events and calendar appointments. 800-343-5414.

Compact Publishing has released its Multimedia MBA CD-ROM software package, which should appear on shelves for less than $100. It's an all-in-one business startup and advice package that includes instructional how-to videos, productivity software, legal guidance, promotional guides, health care information, negotiation tactics, a dictionary of terms, and a PIM program called Briefcase. The package can be used with or without the included multimedia files. 800-227-5609, 202-244-4770.

SBT Accounting Systems is now shipping its high-end SBT Professional Series 3.0 accounting software. This version adds a revamped user interface, more options for sharing data with other Windows applications, more robust graphing functions, and extensive customization tools. The package lists for $895 for a five-user license or

NEW

Single Card Provides One-Stop I/O

Short on slots? With the F/PortIDE, from **FarPoint Communications,** you can take care of a variety of input/output needs in a single slot. The card provides a controller for two IDE hard disks, a controller for two floppy disk drives, a game port, two 16550 UART–compatible serial ports, and an IEEE 1284–compliant parallel port. The parallel port supports the Enhanced Parallel Port and Extended Capabilities Port protocols, which will be implemented in Microsoft Windows 95. FarPoint says the F/PortIDE offers throughput 10 to 50 times as high as that provided by ordinary parallel ports.

▶ **F/PortIDE.** List price: *$129.* FarPoint Communications Inc., *Lancaster, California; 805-726-4420; fax, 805-726-4438.*

Circle 413 on reader service card

NEW

Express Puts Lotus Notes In the Fast Lane

Lotus Development Corp. now offers corporate accounts and other multiuser customers the option of extending Notes distribution for less than $100 per copy (in quantities of 100 or more). Notes Express, a new Notes client, includes client/server-based e-mail, discussion databases, news and reference databases, and a shared phone book. Business professionals get an easy-to-use workgroup-integration program, Lotus says, while MIS departments benefit from the ability to extend groupware applications, basic information dissemination, and collaboration capabilities to all of their users. Express takes advantage of Notes' inherent services, such as replication, security, full-text search, and cross-platform compound document storage.

▶ **Notes Express.** List price (estimated): *$100 per copy in quantities of 100 or more.* Lotus Development Corp., *Cambridge, Massachusetts; 800-828-7086; 617-577-8500.*

Circle 414 on reader service card

NEW

Connect Via Phone Line or Thin Air

The PocketPlus modem from **Sierra Wireless** has nearly unlimited connection options. The battery-powered modem will allow you to send and receive data at 19.2 kilo-

THE NEW WIZARD OZ-9520FX.

It's the latest addition to the #1 selling line of personal information organizers. It features a pen-based graphical user interface, 512K of

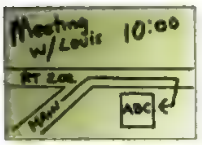
memory and all the tools you could ever want in a 10.5 ounce package. And the new "ultra-compact fax modem" only adds 1.27 ounces and requires no additional cables or setup for use. Best of all, it can remain attached to the Wizard and still fit in a pocket or purse.

The unit's built-in fax software permits users to send a drawing, a letter, or even an entire folder of documents. The software also provides a speed-dial directory and automatically creates a cover sheet for outgoing faxes. By entering the terminal mode the OZ-9520FX uses ASCII or VT-100

emulation to send and receive electronic mail and connect to on-line services like CompuServe®.

A word processor with cut, paste, and a variety of text styles enables you to produce professional-looking letters. Completed documents can then be beamed to a colleague's Wizard or output wirelessly to a PC-compatible printer with the optional infrared adapter.

Scrapbook allows you to draw and store hand-written words or maps and diagrams



directly on the screen using the Wizard's stylus or your finger. Images can also be imported from a PC or Mac® into Scrapbook enabling telephone entries, for example, to have portraits or maps attached to them. A unique Filer system–of graphically represented folders–groups related information together by subject, making it ideal for project management.

And when it comes to time management, Wizard sets the standard. Four different calendar views, 3 phone directories, a To Do list, and there's even a function that allows you to enter annual events, like birthdays and anniversaries, so you'll never miss a moment.

The Wizard is your virtual office. No matter where the day takes you, creating a spreadsheet is as easy as inserting the optional PenCell® spreadsheet card.

Using Computer Link software, data can be transferred to and from a PC or Mac.® And the optional wireless adapter enables Wizard's infrared technology to make this transfer effortless.

And if you ever have any questions there's even a built-in tutorial with explanations and diagrams for every function. But, until you get one, fax us at 1-800-74-SHARP. We'll answer your questions about the OZ-9520FX and tell you about our high-end OZ-9500 and OZ-9600II series. Or call us at 1-800-BE-SHARP and we'll help locate your nearest dealer. It's just about the only thing this Wizard can't do for you.

(IT WOULD BE EASIER TO TELL YOU WHAT IT DOESN'T DO)

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SHARP.
FROM SHARP MINDS COME SHARP PRODUCTS™

LCD

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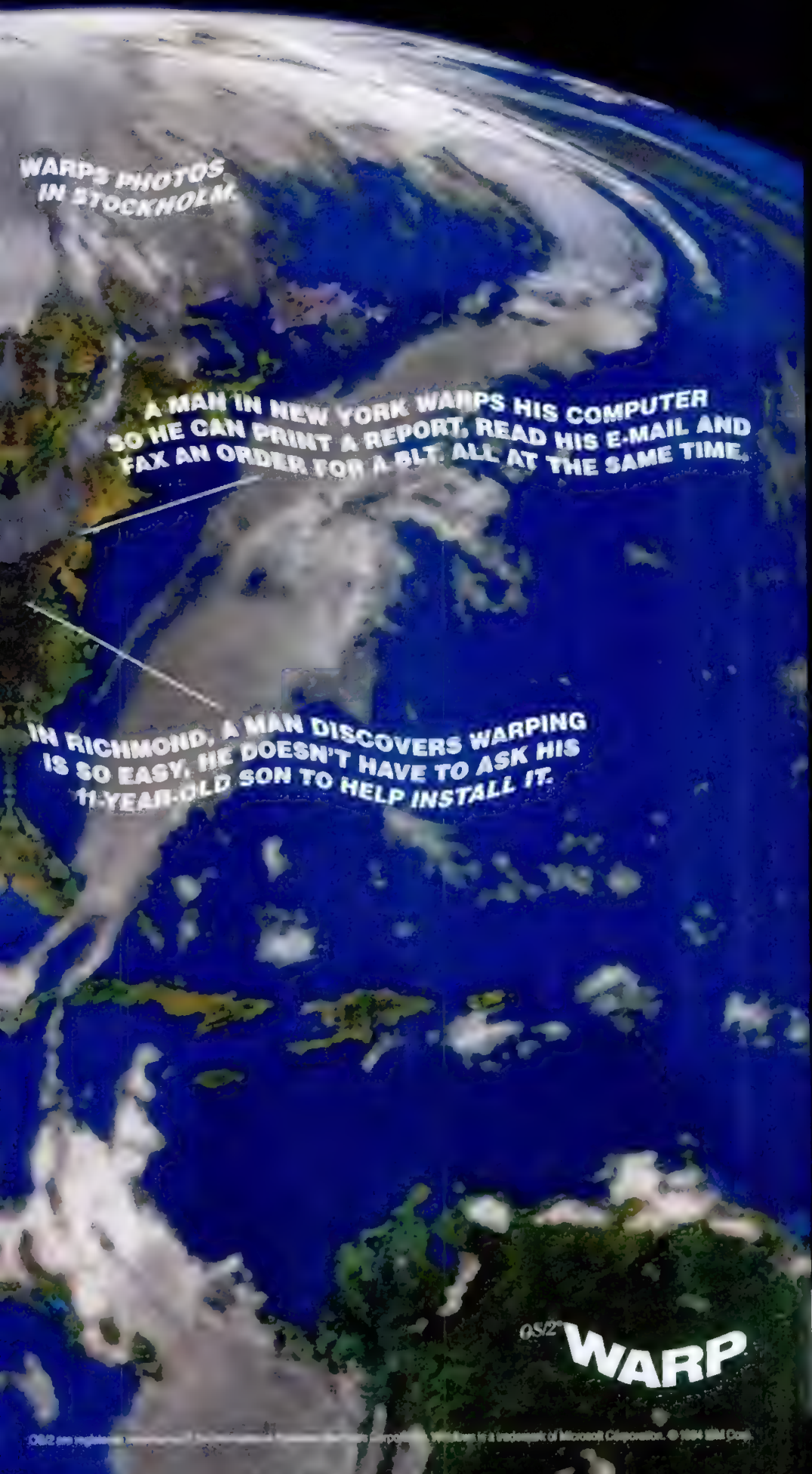
CORDLESS TELEPHONES • TYPEWRITERS • WORD PROCESSORS • WIZARD® ORGANIZERS

©1994 Sharp Electronics Corporation. CompuServe® is a registered trademark of CompuServe, Inc. Mac® is a registered trademark of Apple Computers, Inc. PenCell® is a registered trademark of PenWare, Inc. Simulated screen image

A WOMAN IN TORONTO
OF THE KIDS TO GRANDMA
BECAUSE HE GOT WARPED, A STOCKBROKER IN
SAN FRANCISCO SURVIVES A CRASH INTACT.
AN ASTRONOMY STUDENT IN OHIO
WARPS ONTO THE INTERNET. AND
DISCOVERS A WHOLE NEW WORLD.
AN UP-AND-COMING ARTIST IN SANTE FE WAS AMAZED
THAT HE COULD GET WARPED FOR UNDER $90.
A MAN IN NEW ORLEANS WARPS HIS WINDOWS
INTO POWER WINDOWS.


WARPS PHOTOS IN STOCKHOLM.
A MAN IN NEW YORK WARPS HIS COMPUTER SO HE CAN PRINT A REPORT, READ HIS E-MAIL AND FAX AN ORDER FOR A BLT. ALL AT THE SAME TIME.
IN RICHMOND, A MAN DISCOVERS WARPING IS SO EASY, HE DOESN'T HAVE TO ASK HIS 11-YEAR-OLD SON TO HELP INSTALL IT.
OS/2® WARP

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OS/2 WARP

The new 32-bit, multitasking, multimedia, Internet-accessed, crash-protected, Windows™-friendly, easy-to-install, **totally cool** way to run your computer.

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IBM

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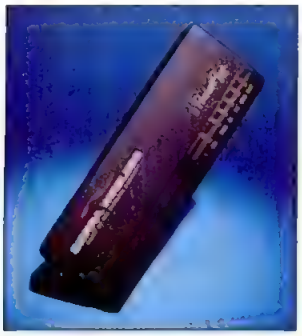
bits per second over the forthcoming wireless Cellular Digital Packet Data (CDPD) network. The same compact device (roughly the size of a hand-held cellular phone) will also handle 14.4-Kbps V.32bis data and V.17 fax communications over circuit-switched cellular and Public Switched Telephone Network (PSTN) facilities. The device includes a cellular transceiver and rechargeable battery pack, and connects to a serial port on both PC and Macintosh systems. With CDPD power-saving mode enabled, the PocketPlus has a 12-hour battery life. An included AC adapter can also recharge the unit's batteries.



Sierra's PocketPlus works with or without a phone line.

CDPD service is currently available in a number of metropolitan areas in the U.S., and it should be available in the 60 largest markets by the first quarter of 1995. Sierra is currently developing optional software that would give local area network users the ability to run LAN client software remotely simply by clicking on an icon.

▶ **PocketPlus.** List price: *$1,195.* Sierra Wireless Inc., *Richmond, British Columbia, Canada; 604-231-1100; fax, 604-231-1109.*

Circle 415 on readers service card

IMPROVED

Make Your CD-ROM Drive as Fast As a Hard Disk

Version 1.1 of the d-Time accelerator utility from **Ballard Synergy** keeps your CD-ROM drive from holding back the performance of the rest of your PC. According to the company, CD-ROM access speeds approach those of hard disks when you use the d-Time utility, dropping from 200 milliseconds to 10 milliseconds for a quad-speed CD-ROM drive. Improvements are even more dramatic on triple- and double-speed drives. d-Time boosts performance by copying critical data from the CD-ROM to your hard disk. The new version also supports enhanced IDE hard disks, Novell DOS 7, and 4DOS.

▶ **d-Time, Version 1.1.** List price: *$69.95.* Ballard Synergy, *Silverdale, Washington; 800-692-0492, 206-656-8070; fax, 206-656-8205.*

Circle 417 on reader service card

BRIEFS

SOFTWARE

$1,295 for an unlimited number of users 800-944-1000.

Independent programmer Gary Tessler has updated his Tessler's Nifty Tools (TNT) DOS and Windows utilities suite with two new tools. GRP2INI converts encoded Windows 3.0 and 3.1 group (GRP) files into ASCII text for you to edit. Once your editing is complete, use INI2GRP to reconvert the file into the encoded GRP format that Windows requires. Any of the more than 30 TNT utilities can be purchased directly for $19 each. The entire TNT group is available for $159. 510-244-5449.

Accent Software International has released a streamlined version of its multilingual word processor, Accent, called Accent Express. The $59 product allows you to type in 34 languages—you choose one simply by clicking on a country's flag—and you can choose from among eight different languages for menus and dialog boxes. Accent Express offers the full word processing functionality of its parent program but lacks spell-checking and other complex features. 800-535-5256; fax, 800-535-5257.

HARDWARE

Ensoniq has released the SoundscapeDB, a daughterboard that plugs into any 26-pin expansion connector on an FM sound card to deliver wavetable synthesis. The SoundscapeDB supports 16 channels and 32 simultaneous voices, and doesn't require any software to operate with any compatible host. The $129 unit snaps into place. 800-776-8637, 610-647-3930.

Mustek is shipping its Plug-and-Scan 256, a PCMCIA-compliant hand-held scanning solution. The package includes the GS-400L, a low-power hand-held scanner that delivers 400 dpi in 256 gray-scale mode; the Mustek ScanCard, a hot-swappable PCMCIA interface that connects to the scanner; U-Lead Systems' iPhoto Plus capturing and editing program; and Perceive Personal, an OCR package from Maxsoft-Ocron. Plug-and Scan's estimated street price is $249. 714-250-8855

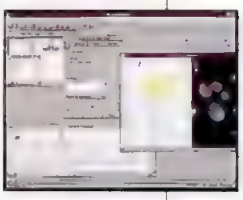
NEW

ResearchStation: Your Science Notebook

If you need to organize data that comes in many different forms from many different sources, you may want to investigate ResearchStation from **Megalon.** Designed primarily to handle scientific data, ResearchStation relies on OLE 2.0 to create links with other Windows applications and lets you import data—regardless of format—into a single window. The package provides document tracking and management, security options, and support for collaborative work environments. You can automate routine tasks such as data acquisition and monitoring with the ResearchStation Minder. A network version is also available.

NEW & IMPROVED PLUS

You can download a working demo of ResearchStation (RESEARCH.ZIP) from Library 4 of the Editorial forum on ZiffNet. Type GO EDITOR at any CompuServe ! prompt



Download Megalon's ResearchStation.

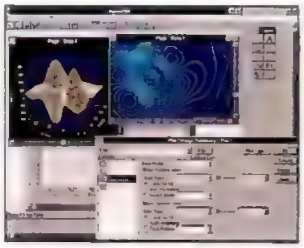
▶ **ResearchStation.** List price: *$995.* Megalon, *Novato, California; 415-884-3000; fax, 415-884-2279.*

Circle 416 on reader service card

IMPROVED

SigmaPlot 2.0 Produces Custom Graphs

Jandel Scientific Software is now shipping Version 2.0 of its SigmaPlot graphing software. The SigmaPlot package allows you to generate technical plots and customize your graphs by controlling line thickness, axis types, symbol choices, and error bars. Version 2.0 adds an automatic legend generator, multiline text support, a new custom zooming feature, and improved performance



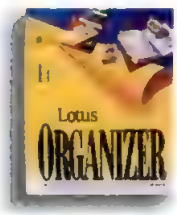
SigmaPlot automatically turns data into graphs.

Photograph by Jeff Krein

BLACK HOLE (ARTIST'S CONCEPTION)

"THIS MEETING WAS SUPPOSED TO START A HALF HOUR AGO. WHERE IS EVERYBODY?"

It's a proven fact. Busy schedules and poor communication create black holes

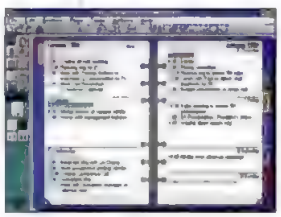


that suck up co-workers just before the big meeting. Scientists can explain a lot about these powerful gravitational fields, but they can't help you get people together on time.

Only Organizer™ can do that. Because now Lotus Organizer™ 1.1 Personal Information Manager for Windows works across your existing ccMail™ network to make scheduling a meeting – as well as planning your day – easier than ever.

You simply choose who you want to attend from the ccMail directory. Organizer shows you a graphical view of their busy and free times so you can pick out the optimal meeting time. Then Organizer delivers an invitation via ccMail. Invitees can accept, decline or delegate to someone else – with a single mouse click. Organizer tracks responses automatically. No searching for missing co-workers. No phone tag. Just the easiest way ever to plan a meeting.

Organizer's group scheduler displays a user's *availability only*, not the entire schedule, so everyone's privacy is protected. And invitations can be sent to anyone on the ccMail network, even if they don't use Organizer.



Lotus Organizer with group scheduling takes the guesswork – and the footwork – out of meeting planning.

Needless to say, Organizer does more than plan meetings. Organizer includes an on-screen calendar, an automated to-do list, an address book, note pad and anniversary reminder – Organizer will even sound an alarm to remind you of a commitment, like that meeting you're invited to.

There are three ways you can get Organizer: on its own, with ccMail in the 10-user group pack, or for an even better deal upgrade to SmartSuite®– a suite of five top-notch, fully integrated business applications, including Organizer– for just $299.* Call **1-800-872-3387, ext. A312**, or visit your Lotus Authorized Reseller. Because, as common as they are, black holes at work are now entirely preventable.

Lotus
Working Together®

*$299 promotional price while supplies last. In Canada call **1-800-GO-LOTUS**. Prices may vary. ©1994 Lotus Development Corporation, 55 Cambridge Parkway, Cambridge, MA 02142. All rights reserved. Lotus, SmartSuite and Working Together are registered trademarks and Organizer is a trademark of Lotus Development Corporation. ccMail is a trademark of ccMail, Inc., a wholly-owned subsidiary of Lotus Development Corporation. Windows is a trademark of Microsoft Corporation.

and memory usage. The SigmaPlot Graph Library, Volume One ($99), contains over 150 graph templates to help you communicate data effectively.

▶ **SigmaPlot, Version 2.0.** List price: *$495.* Jandel Scientific Software, *San Rafael, California; 415-453-6700; fax, 415-453-7769.*
Circle 418 on reader service card

IMPROVED

Japanese Word Processor Uses The Power of OLE 2.0

Pacific Software Publishing has added powerful OLE 2.0 capabilities to Version 3.0 of KanjiWORD, its inexpensive Japanese word processor for Windows. You can create and edit Japanese text from within other OLE-compliant applications, such as Microsoft Excel, PageMaker, and WordPerfect. KanjiWORD lets you open a document in your application and then embed Japanese text. In order to edit text, you double-click on it to bring up the KanjiWORD menu bar. Automatic updating reflects changes that have been made in either KanjiWORD or the linked document. Version 3.0 also features two new TrueType Japanese fonts and user-definable kanji conversion.

▶ **KanjiWORD, Version 3.0.** List price: *$279.* Pacific Software Publishing Inc., *Bellevue, Washington; 800-232-3989, 206-562-1224; fax, 206-562-0811.*
Circle 419 on reader service card

NEW

Client/Server Software That Goes with the Flow

FileNet Corp. has introduced Visual WorkFlo, a Microsoft Windows-based client/server program for workflow management. Visual WorkFlo automates the movement of images, data, text, and other information across a network and helps to integrate the many elements of a workplace. Based on an open, flexible architecture, the program is built around an object-oriented structure that includes graphical authoring tools. The result is a groupware environment that users at any level—from end users to programmers—can quickly create or modify.

▶ **Visual WorkFlo.** List price: *$7,400.* FileNet Corp., *Costa Mesa, California; 800-345-3638, 714-966-3400; fax, 714-966-3490.*
Circle 420 on reader service card

BRIEFS

SkyTel is now offering its SkyCard PCMCIA wireless communications device. The unit fits into any Type II PCMCIA slot and delivers information to the PC. SkyCard comes with mail-management software, a PIM program, and free links to stock quotes and the Reuters news service. You can purchase SkyCard for $249 or lease it for $15.95 per month. 800-759-9779, 601-944-1300

For affordable high-end display capabilities, **Optiquest** has introduced the 4500DC, a 17-inch monitor that features a flat-square screen, digital controls, a 0.27-mm dot pitch, and an Invar shadow mask. The $759 4500DC can manage a maximum noninterlaced resolution of 1,600 by 1,280 dots per inch at a 76-Hz refresh rate. The bundled Opti-Green Energy and Monitor Saving software is Energy Star–compliant and powers down the monitor in user-defined increments to less than 5 watts in Off mode. 818-757-0070.

Antec has introduced the Reliant line of active fault-tolerant power-supply products for mission-critical business applications. Available in a $799 tower enclosure, a $1,699 file server tower, and a $1,799 disk array tower, the Reliant devices cause no power interference to computer components, according to Antec. The products will sound an alarm if the master power supply fails, alerting the user to hot-swap the failed power supply. 510-770-1200

Smith Corona is now shipping its PC Label Printers 1.0 and 2.0, targeted at the SOHO market. The Label Printer 1.0 handles 1 1/8-inch-wide labels, and 2.0 handles labels of up to 2 1/4 inches in width. Each unit measures 8 by 4.3 by 5.1 inches (HWD) and sells for under $200. The included software makes U.S. Postal Service bar codes, manages your mailing list, and imports graphics. 800-448-1018

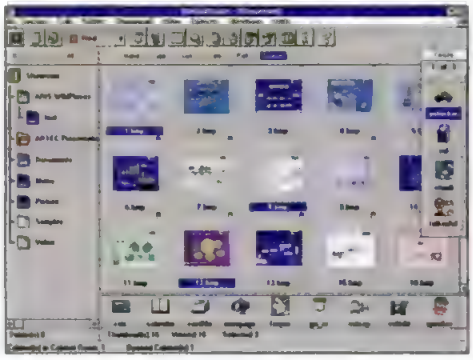
AND FINALLY . . .

Microsoft is currently offering a copy of Shapeware Corp.'s Visio Express 3.0 drag-and-drop drawing software to purchasers of Microsoft Office, and **Lotus** is offering the same promotion to purchasers of Lotus SmartSuite.

NEW

MediaHouse Imposes Order

MediaHouse, from **Ultima International Corp.,** helps keep your directory structure from becoming a tangle of multimedia file formats that seem to sprout in the oddest places. This multimedia file and application manager



AST's Manhattan server now holds dual 100-MHz Pentium processors.

helps you find and work with files created in a variety of different applications. You can organize your files in a simple cabinet and folder metaphor and can search for any specific file on your disk. You can view files via drag-and-drop or launch files and associated applications simultaneously. MediaHouse supports a total of 17 multimedia formats, including .AVI, MIDI, Photo CD, .PCX, and .WAV files. You can sequence video, sound, and graphics into multimedia presentations.

▶ **MediaHouse.** List price: *$99.* Ultima International Corp., *Fremont, California; 800-886-1278, 510-440-1200; fax, 510-440-1216.*
Circle 421 on reader service card

IMPROVED

Multiuser Software Fills the Bill

James Halstead & Associates has introduced Version 2.1 of Billtime, a multiuser time and materials billing and tracking package for Windows. The upgrade adds support for optional projects, phases, and tasks, making Billtime capable of managing large and complex projects. It also lets you export data to a Microsoft Excel spreadsheet for analysis and report generation. Billtime can track up to 20,000 projects, up to 2,000 service or material items, and as many as 1,000 employees.

▶ **Billtime, Version 2.1.** List price: *Introductory price for 10-user version, $295.* James Halstead & Associates, P.C., *Joliet, Illinois; 815-729-1900; fax, 815-729-4055.*
Circle 422 on reader service card

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CIRCLE 206 ON READER SERVICE CARD

THE NEW COMPAQ LTE ELITE. ALL THE FEATURES YOU ASKED FOR. FROM THE DIFFICULT~

At Compaq, we always try to give you the notebook features you've asked for. Even if your requests do seem to stretch the laws of physics. Case in point: the Compaq LTE Elite.

To begin with, we actually found a way to get rid of that bulky AC adapter that you've always had to carry. We built the LTE Elite to have its own **built-in AC adapter**, so when you travel, all you need is a thin power cord.

At your request, we also designed it to be easily expanded. The LTE Elite gives you a choice of fast 486 processors (up to 75MHz) and a **removable hard disk**. It also has **PCMCIA** slots that let you use over 140 Compaq-tested cards. And almost every key component is **upgradeable:** the memory, the display and the processor itself.

We even designed the LTE Elite to make things easier in the office – with the SmartStation and MiniStation **expansion bases.** Both of these options feature built-in networking* and SCSI-2 capabilities for an instant desktop configuration– with ports for your full-sized monitor and keyboard. The SmartStation also adds expansion slots and bays, a spare battery charger and motorized docking.

Of course, the LTE Elite also provides the peace of mind that comes with the Compaq **three-year warranty**** and free **24-hour helpline.**

You can try the LTE Elite for yourself at a nearby authorized Compaq reseller. Or, if you would prefer receiving specifications immediately via fax, just give us a call at 1-800-345-1518, choose the PaqFax option and select document #4023.

With the LTE Elite, you'll find it's hard to make a wrong decision. If not impossible.

COMPAQ

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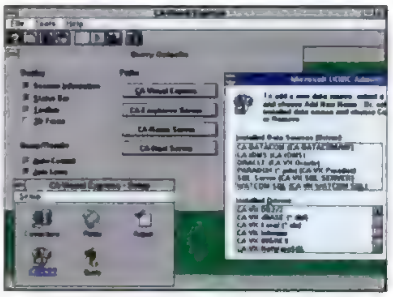

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CIRCLE 400 ON READER SERVICE CARD

Read Only

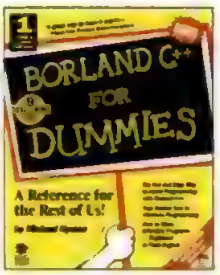
REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Tin Albano

C++ Dummies Get an A+

BY JAY MUNRO

The title *Borland C++ for Dummies* may sound like an oxymoron, but this addition to the famous series from IDG has a lot to say. As with the other *Dummies* books, you need to check your ego at the door while—through icons, cartoons, tips, and tricks—you (almost) painlessly learn C++.



Starting with the installation and basic operation of Borland's C++, the book teaches tricks that make using the program easier, such as getting around the error messages that come up with a CD-only installation. A series of "I want..." sections shows the user how to do specific installation scenarios (such as DOS-only, NT-only, or Windows-only) in simple, numbered steps. If you run into trouble, skip to chapter 39, "(Fewer than) Ten Reasons Why It Didn't Install," and if you're still in trouble, chapter 40 presents "Ten Solutions to Try If It Installs but Doesn't Run."

Following the wise principle of learning by doing, the author has you start by using the AppExpert to build a basic framework, and then he has you begin an ongoing project. The book quickly gives some background on the C language and conventions before launching into C++. Scattered throughout are icons identifying Tips, Things to Remember, and Technical Stuff. Michael Hyman does a good job of slipping in technical information, such as the use of the ++ operator and when to put templates in header files.

Using the Pizza program (named after one of the five food groups for programmers, along with beer, Jolt, chips, and chocolate), the author starts with a simple program and works through functions, structures, classes, inheritance, linked lists, and even exception handling. By the time you're done, you've created "Pizza++," which includes all of the above and more, such as friend functions, operator overloading, and virtual functions—and you actually know what you're doing throughout.

Almost every chapter proclaims, "But Wait. There's More." And in fact, *Borland C++ for Dummies* includes ten Rich Tennant cartoons, "bazillions" of code snippets, and a concise glossary of programming and words specific to C and C++. In sum, *Borland C++ for Dummies* mixes a lot of silliness, wordplay, and hard-core C++ information together to make a surprizingly easy-to-read book that can help beginning programmers (as well as some seasoned ones) get up to speed on the latest object-oriented language.

▶ **Borland C++ for Dummies,** *by Michael Hyman, $19.95; IDG Books, 800-227-8365; ISBN: 1-56884-162-0.*

Circle 401 on reader service card

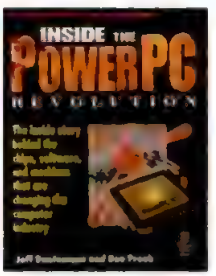
The PowerPC Revolution

BY DANIEL GROTTA AND SALLY WIENER GROTTA

After reading this superbly researched, information-filled page-turner, one gets the growing feeling that choosing a Pentium-based system might be something like whistling past the graveyard. While *Inside the PowerPC Revolution* is ostensibly all about the development and attributes of the PowerPC RISC processor, it is also an indictment of CISC processors —and Intel's Pentium in particular.

Jeff Duntemann and Ron Pronk have clearly done their homework in detailing the IBM/Apple/Motorola alliance to develop a new generation of CPUs and stop the Intel juggernaut. The book begins with a brief history of the desktop microcomputer that helps explain the myriad factors that go into CPU design, as well as the technical considerations that led IBM, Apple, and Motorola to select RISC over CISC. The book also addresses some lingering questions: Why did the first generation of Pentium-based machines run so hot? What can we expect next year from the Pentium clones to be released by AMD, Cyrix, and others?

The book's authors explain what registers are and why the Pentium is register-poor; the difference between primary and secondary caches; and the importance of pipelines, superscalars, and load/store architectures. The authors manage to ferret out little-known but telling facts, such as the actual chip manufacturing costs of a Pentium ($480) and the PowerPC ($76), what microkerneling is, and why the PowerPC can't support Motorola's own DSP accelerator chips.



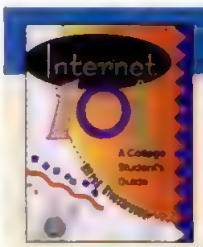
Much of the book focuses on Apple's current generation of PowerMac systems, and the wizardry engineering that allows them to run not only native-mode and 68K software but Windows 3.1 in standard mode.

Inside the PowerPC Revolution is written in stylish, down-to-earth language, reminiscent of Tracy Kidder's Pulitzer Prize–winning book *The Soul of a New Machine.* Aside from being an entertaining, illuminating work, it should be required reading for every corporate buyer who makes the agonizing decision of which CPU to use in his company's next generation of computers.

▶ **Inside the PowerPC Revolution,** *by Jeff Duntemann and Ron Pronk, $24.95; Coriolis Group Books, 800-227-8365; ISBN: 1-883577-04-7.*

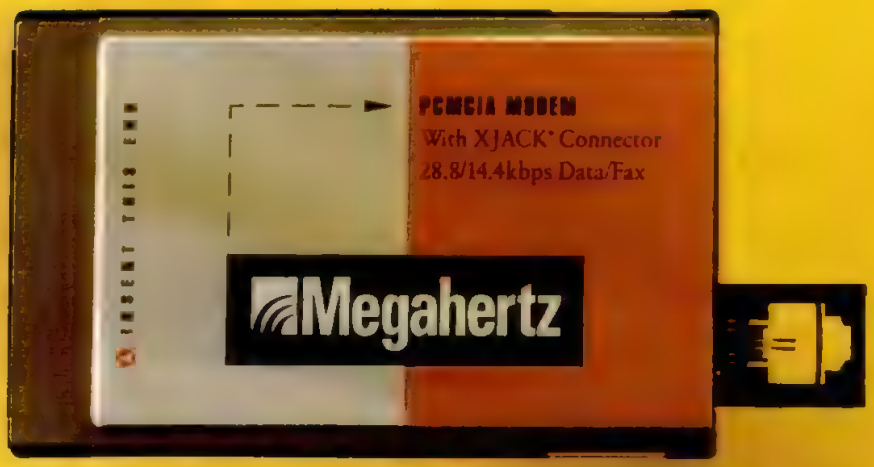
Circle 402 on reader service card

Read Only Recommends



The Internet is fast becoming an intregal part of campus life. Students will find Alfred Glossbrenner's *Internet 101: A College Student's Guide* a worthwhile class to take. $19.95; Windcrest/McGraw-Hill, 800-822-8158; ISBN: 0-07-024054-X.

Our New 28,800bps Modems With XJACK® Are Revolutionary.



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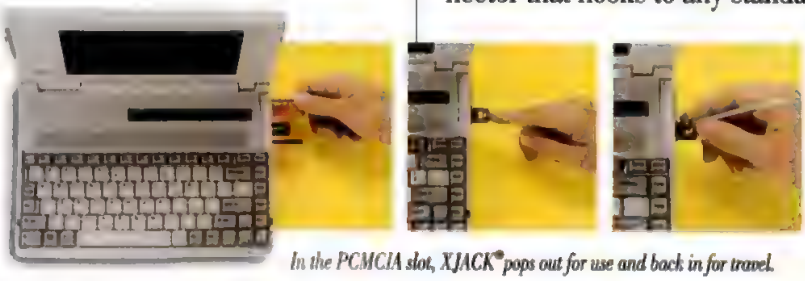

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Others Are Bound By Convention.

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CIRCLE 321 ON READER SERVICE CARD

386-based PCs

486-based PCs

Let's say compute

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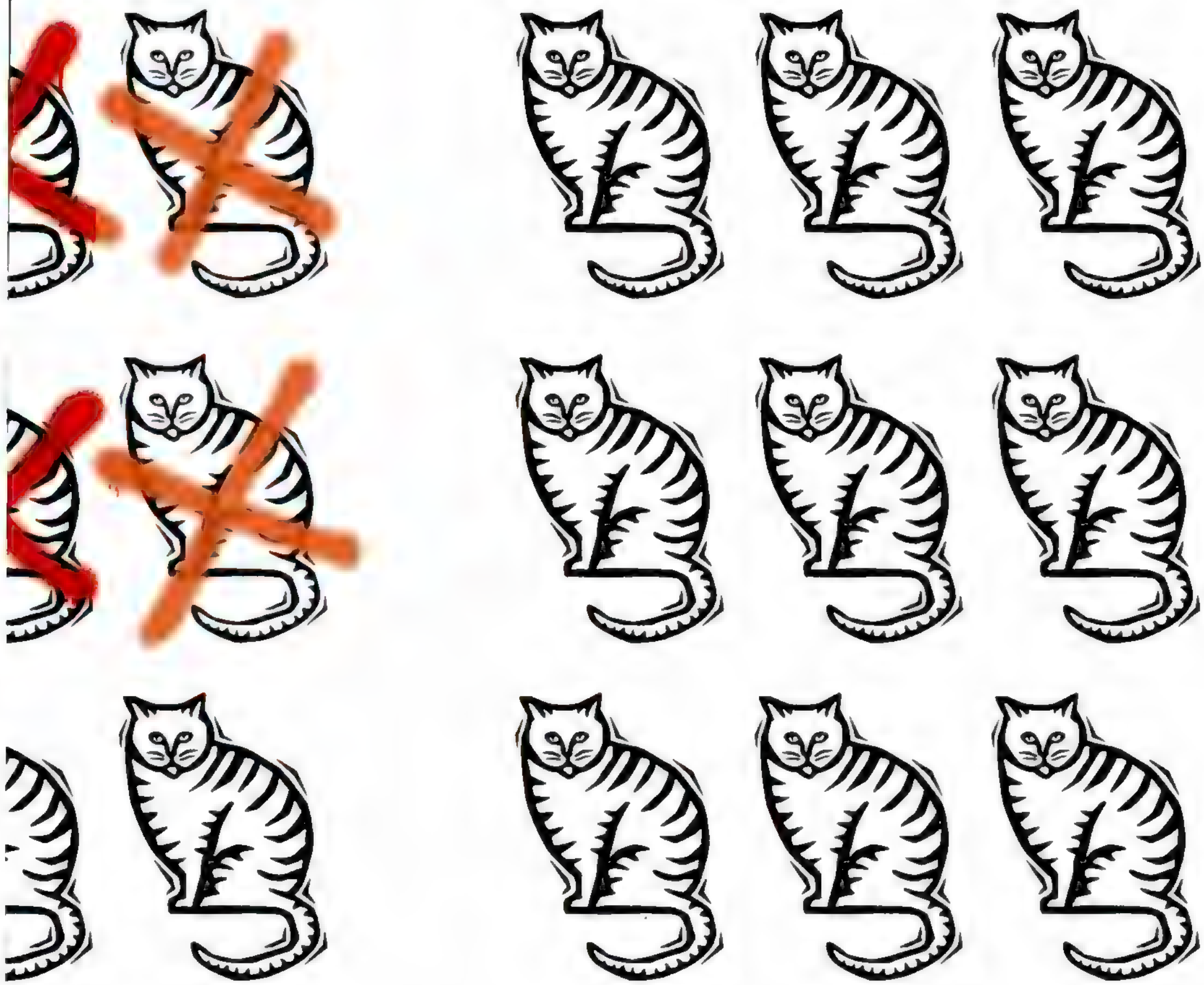

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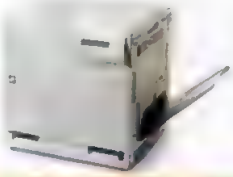

Tektronix

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CIRCLE 001 ON READER SERVICE CARD

Michael J. Miller

What Will We Want Next Year?

Every year, as we debate over which products should receive our annual awards for technical excellence, I marvel at how far technology has come, and wonder about how far it still has to go. Just look at the products we deliberated over this year (see this issue's cover story, "The 11th Annual Awards for Technical Excellence"). In 1994 we saw a 4-pound 486 portable with an active-matrix color screen and great battery life, impressive color printers, new modems that offer faster dial-up connections, and new switching hubs that offer improved network performance.

On the software side, we saw new communications tools that make worldwide communications not only possible, but fun; great suites of consistent, powerful productivity applications; a personal database with sophisticated development and data management tools; and graphics programs that let you do things you didn't think possible a couple of years ago.

INSATIABLE PC DESIRES

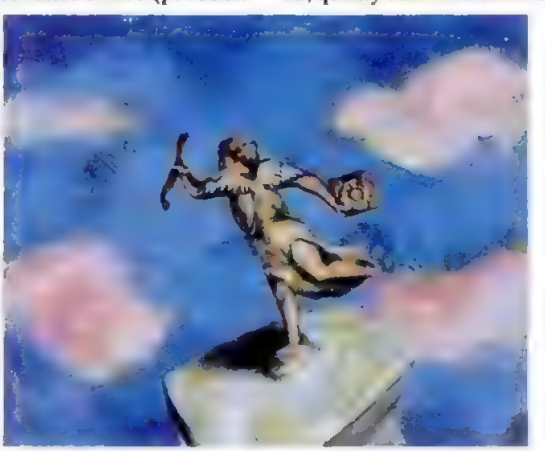
Although we've seen a lot of change in the past year—and it's definitely been exciting—we still want more. We're never satisfied. That's just the way the computer industry goes.

Look at the products that either aren't slated for release until next year or just missed the cutoff date to be considered for a Technical Excellence award (products needed to be shipping by the end of September 1994):

- **IBM's new OS/2 Warp,** Version 3, brings a true 32-bit multitasking, multiprocessing operating system within the reach of 4MB machines and integrates Internet access.
- **Novell's PerfectOffice** promises more integration and cross-application macros than any suite we've seen thus far.
- **Component Integration** Labs' OpenDoc presents an alternative standard that developers can use to create smaller objects that they can then turn into integrated applications.
- **Taligent Application** Frameworks provides an entire system based on smaller objects.

We're beginning to see new laptop computers with built-in CD-ROMs, as well as those with Pentium processors. IBM and Motorola's new PowerPC 604 chip promises new speed and integration in the RISC world, while new processors from AMD and Cyrix promise performance at the Pentium level and beyond. Not to be outdone, Intel is quietly talking about P6, its next-generation Pentium processor.

It's quite a list. But is it satisfying enough? Consider Lotus Notes, the product we used to conduct this year's Technical Excellence discussion at the magazine, connecting our offices in New York and California with our contributing editors across the country. Notes is an amazing package that has changed the way we look at software. Its ease of tracking discussions, great forms capability, and replication features made our discussion—which comprised some 1,500 messages—far easier to manage than our e-mail–based discussions of years gone by. But even Notes has its problems, including its size, relatively weak e-mail features, and outdated, quirky user interface. Once again, we're still not satisfied; things get better, but we always want more.



No matter how much computer technology improves, we'll still want more.

WHAT DO YOU WANT?

Someone recently asked me, "What are the five technological advances you most want to see in 1995?" I thought about it a bit, and here's what I came up with.

- **Better communications** software. It has improved, but communications software still stinks. I want to see a universal e-mail system that really works, much-improved gateways between systems, easier-to-use interfaces, the ability to use the word processor of my choice as my e-mail edi-

Illustration by Clemente Botelho

tor, and easy replication of e-mail in-boxes on different machines. And of course I want complete reliability and great administrative tools. In short, I want everything.

• **Multimedia standards that really work.** Almost everyone has run into this problem. You get a hot new CD-ROM and realize it just doesn't work with your system. You realize you're going to need to change your configuration—or worse, change your hardware. You may even have to download a new video driver that works with the current Video for Windows or QuickTime for Windows driver. Come on, folks: We can do better than this! (All you Macintosh fans, stop smirking. Multimedia is better on Macs, but I still occasionally find myself looking for some missing INIT file.) Microsoft and Intel swear that Plug and Play and Windows 95 will change all this; we can only hope.

• **Real component software.** I don't really care whether the answer is OLE, OpenDoc, Taligent Frameworks, or Visual Basic components. I do care that we get to a point where departmental computer experts and even end users can start mixing and matching tools from multiple vendors to create applications that are really customized for the way we work. This requires not only that the big software vendors create their applications in components—and allow them to be scripted together—but that they make sure their components work with one another. And it demands that we see some of the smaller, more innovative companies coming out with solutions aimed at particular marketplaces.

• **Better tools for electronic publishing.** Maybe this is just because of what we do here at the magazine, but I'm convinced that today's publishing tools have a long ways to go. On the desktop publishing side, workgroup features—such as managing and tracking who is using and who has read particular files—are afterthoughts at best. Since workgroup features are going to play an integral role in the way we use software to work with one another, they need to be much better. The tools for creating CD-ROMs are too complex and riddled with problems that need to be worked around. The tools for posting materials on-line—whether on the Internet or on commercial services—are very primitive. In all these areas, I expect (or at least hope) to see major improvements.

• **Light, portable desktop replacements.** I admit it: Like everyone else, I want all the functionality of my desktop to fold up into a 1-pound notebook with infinite battery life. I won't get that anytime soon, but I can dream. In the meantime, I'd settle quite happily for a 4- or 5-pound machine with a Pentium processor, built-in CD-ROM drive, 800-by-600 display, and 3- or 4-hour battery life. Don't laugh: I expect to see this in the next year or so.

That's the list I came up with. I could ask for a few other things, such as the ability to get an ISDN line at home, but that's not a technical issue. One thing you'll notice is that my list doesn't specifically ask for faster computers. Speed is important, but mostly only in that it's an enabling technology, allowing developers to create better and more powerful applications.

What would you like to see in the next couple of years? Drop me a line at MCI (247-8102), at CompuServe (72241,352), or on the Internet (157.9301@mcimail.com), and I'll run the best responses in a future column. □

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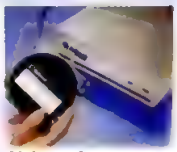
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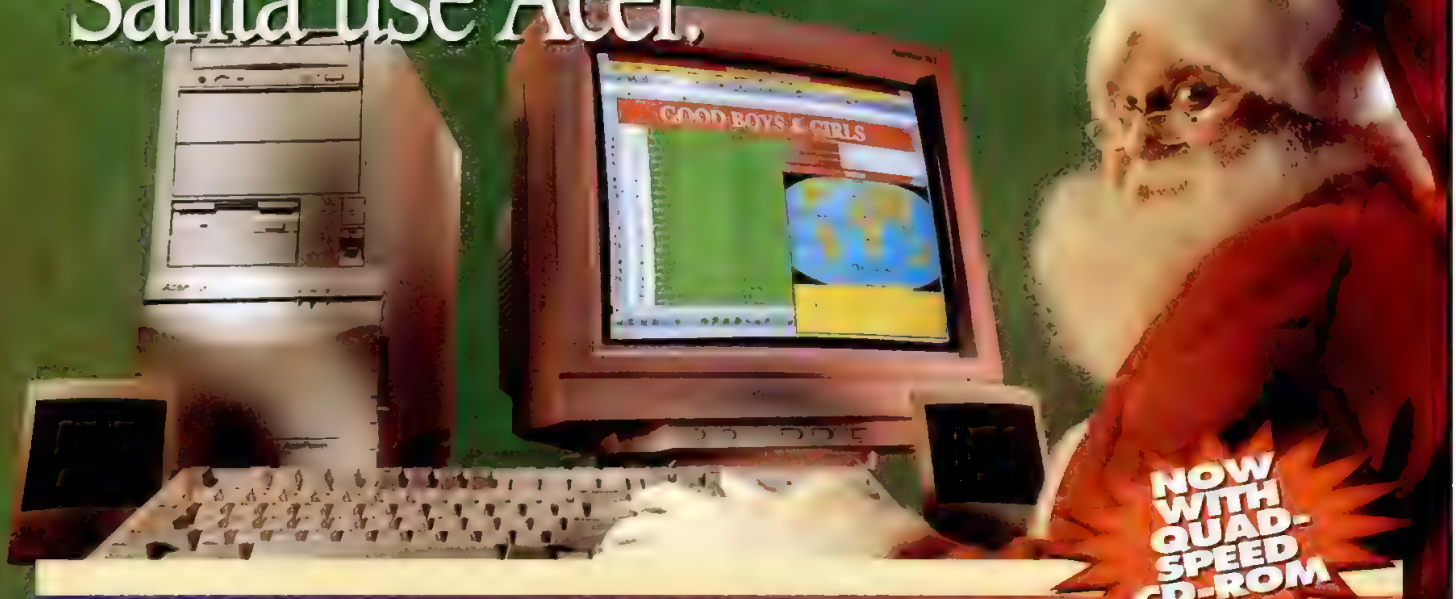

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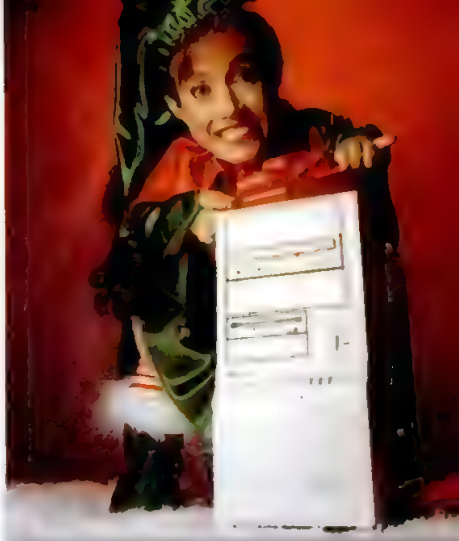

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Bill Machrone

The Digital Phone Fiasco

I'm going to share some arcane but vital information about modems with you. If you travel with a laptop machine with a PCMCIA modem, you risk destroying your modem whenever you plug into an unknown telephone system.

I learned the hard way, after I forgot that a phone system at an office where I often visit had been upgraded over the weekend. I plugged in and was surprised that my call to send my e-mail didn't go through. By the time I remembered that they had switched from an analog to a digital phone system, the damage was done. Here's why:

Analog phone systems provide a direct-current signal to each phone. When you pick up the handset, a switch closes in the telephone and a current flows over the wires, called tip and ring. Equipment at the central office detects the current, and listens for your touch tones. The telephone company's equipment limits the current, typically to 60 milliamps or less.

Digital phone systems work differently. Like a LAN, a PBX communicates in digital pulses with the desktop handset. Because a PBX provides the power to run the microcontroller and other features in the desk set, more current is typically available on the phone lines. Some systems provide more than 90 milliamps.

Modems act just like traditional telephones: An internal switch connects tip and ring together. This switch is an electromechanical relay in most modems. PCMCIA modems, however, because of their small size, can't fit such a relay and use a solid-state relay instead. The solid-state relay is designed to dissipate the heat from a 60-milliamp current and to withstand the higher AC voltages from a ring signal. Most PCMCIA modems cannot dissipate the additional heat caused by the higher currents available on digital systems; the part of the modem that connects to the phone line (called the DAA) dies, leaving the rest of the modem operating normally.

I was naturally distraught when I lost my modem, but I had no idea how widespread this problem was until I started cruising the various on-line forums where people talk about modems and vendors provide support. Virtually all new notebook computers use PCMCIA modems, and judging from the volume of messages, they're dropping like flies.

The problem got so bad at IBM that the field service group created a penlike test instrument that they could distribute to the thousands of employees who travel with laptop computers. The IBM Modem Saver has a green light for a normal line and a red one that indicates damaging amounts of current. IBM now sells the Modem Saver direct (800-388-7080) for $29.

It's not that hard to figure out if a desktop phone is digital. Turn the phone over and look for an FCC ringer equivalence number. Only analog phones have them. The real question is whether that empty jack next to the one the phone's plugged into is an analog line for data calls or another digital line. That's when the Modem Saver comes in handy.

We who live on the road must have a code, and it's usually 9 for an outside line. Fortunately, most hotels have modem-friendly analog lines or provide an analog dataport on their digital phones. The real obstacle to communication is an office with no analog phone lines. If you absolutely have to find an analog line, you can unplug a fax machine, but you won't win any popularity contests with shenanigans like that. Fortunately, there's another solution. Even digital phones have an analog aspect—your voice and that of the party you're calling. A number of devices let you plug right into the handset cord, so you can use your analog modem with virtually any digital phone and PBX.

Unlimited Systems Corp., which pioneered the first handset cord couplers,

Somewhere, a killer phone system lies in wait, ready to destroy your modem.

Illustration by Clemente Botelho

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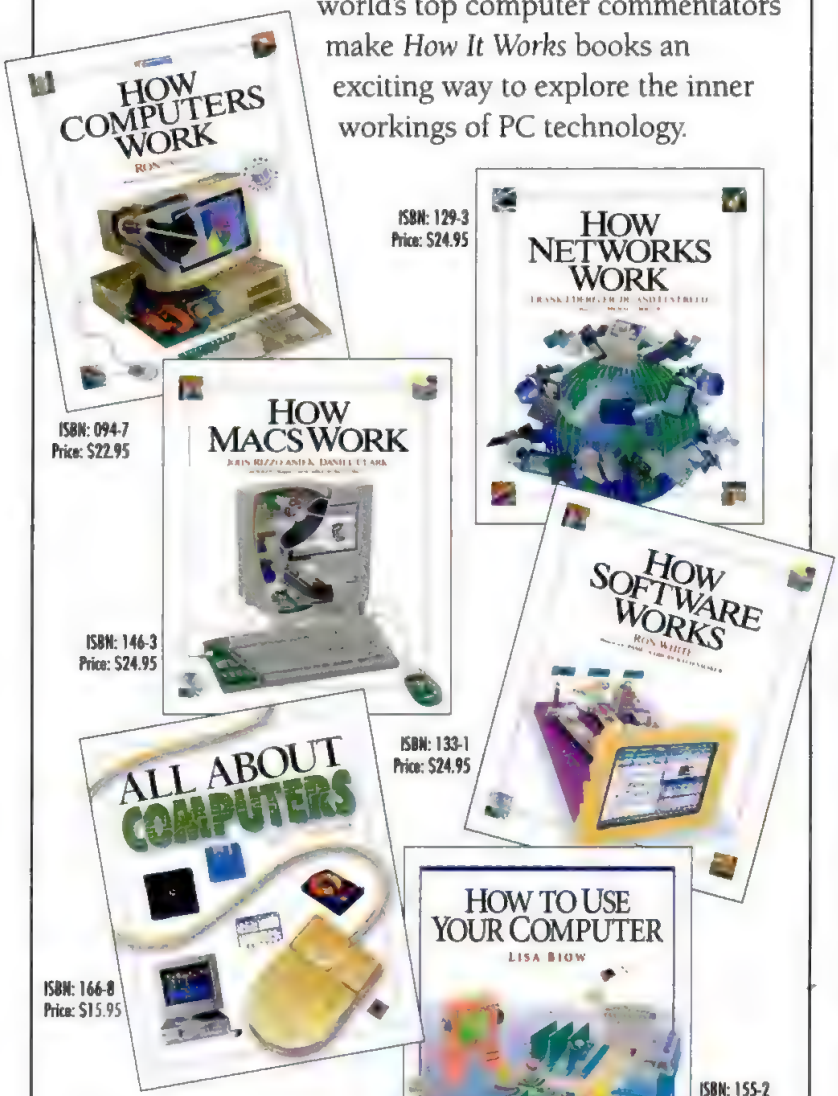

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leads in this market with its Konexx product line. IBM sells a slightly modified version of the Konexx coupler, called the Digital Phone System Enabler (800-275-6354). Radish Communications (303-443-2237) has entered this market, too, with its InsideLine adapter. If you travel abroad, however, you'll eventually encounter a phone system that will defeat your best attempts to hook in. Konexx has the ultimate answer. The Konexx Koupler 204 is an acoustic coupler that fits even the weirdest French phones (France seems to have the market cornered on oddball phone systems). The Koupler bears no resemblance to the clunky, unreliable acoustic couplers of old. This one connects at 9,600 and 14,400 bps on digital phone systems, but it can eke out only 2,400 bps on standard pay phones.

PROTECT YOURSELF

Still, these external devices may seem like an awful lot of trouble to go through for what amounts to a design deficiency in PCMCIA modems. There's one modem line on the market that can protect itself. Megahertz's 1144 and 2144 modems detect high current lines and issue messages from internal ROM to the screen. The modem then refuses to go off-hook while the high current is present. Unfortunately, unless you use a standard communications program, you'll never see the warning: E-mail organizers, graphical packages for on-line services, and applications such as Lotus Notes all mask messages from the modem.

Modem vendors are painfully aware of the problem, and every manufacturer I've contacted is in the process of specifying higher-current solid-state relays for their modems. Within six months, the problem will have vanished—but only for new products. Existing products will always be susceptible. I wouldn't be surprised to see some enterprising manufacturer build an in-line circuit breaker that detects high-current lines and protects your modem accordingly.

The real source of the problem is the digital phone system manufacturers. They should never have used the same RJ-11 connector that analog phones use. Yes, the RJ-11 is ubiquitous, inexpensive, and extraordinarily effective. But a simple blocking key on digital jacks and a matching notch on the plugs could have avoided the problem entirely.

Now that you know the danger, connect with care. □

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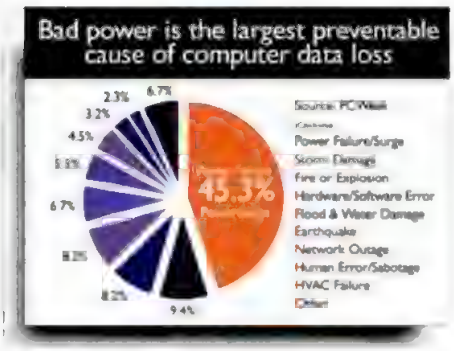

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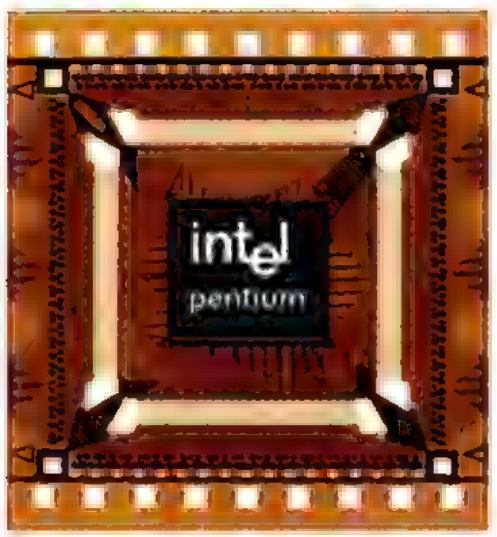

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CIRCLE 038 ON READER SERVICE CARD

John C. Dvorak

The Perfect Notebook, 1995

If you've ever owned a notebook PC or wanted to, you must read this column. Every year for the past decade, manufacturers have given us dozens and dozens of notebooks, each better than the previous generation. Still, I have yet to find a machine that's satisfactory. Let's review my perfectly reasonable complaints.

One problem is cursor control. That little nub you find on the Thinkpad, Toshiba notebooks, and other machines may be a nice innovation, but it's very difficult and annoying to use. The one on the Toshiba Portégé 3400 and 3600 machines with the shrunken keyboard is especially difficult to use. For the past year, I've been using the 3400, the one with the great screen, as my road-warrior machine. I think it's the closest to my ideal computer. The dinky keyboard takes a little getting used to, but it's acceptable. The machine is also a bit too thick for its weight, but its thickness protects the screen from damage.

I used to break screens in my suitcase. I travel with a hard-case Samsonite with the built-in rollers. I prefer to pack the machine in the suitcase, as I'm seldom stopped at security (even on international flights) when I travel this way. Announce that you're carrying a notebook and you'll be stopped and asked to turn it on. Putting it in a separate laptop carrying case makes this announcement for you.

Anyway, I'd still prefer a full-size keyboard and a better pointing device. Though still better than a trackball, the little TrackPoint on the Toshiba is too tight, requiring too much force for my taste. Trackballs always get dirt inside them and fail. The new Apple touchpad may be a solution. Whatever the case, cursor control has no perfect solution.

So let's look at the ideal notebook. Over the years, my ideas have changed, and now I'm close to specifying the perfect notebook. And it's a killer. First of all, the case is made from graphite composite like a tennis racket. Very light and hard. The screen is a 10-inch-wide, active-matrix, color LCD capable of 1,024-by-768 resolution. The keyboard is full-size, and the notebook measures 8.5 by 11 by 1.5 inches. My year-old 3400 is about 7.9 by 9.8 by 1.8 inches. Except for the thickness and small screen, this easily beats my specifications.

I'm also enamored with the fold-up keyboard that IBM is experimenting on. But until the LCD screen can be folded from 10 inches to 5 inches, I don't see that it's necessary.

Now let's see the guts of my ideal notebook. It's got the newest magneto-resistive hard disk, a one-platter 2.5-inch hard disk that holds 300 to 600 megabytes of memory. Sounds good to me. Let's ensure at least 500MB on the disk. The floppy disk drive and CD-ROM drive are lightweight clip-ons just as Toshiba's are. Dell's elegant non-backlit recalled flopperoo from some years back had the add-on floppy disk drive perfected. Dell was closing in on the perfect laptop with that machine. Unfortunately, it couldn't be manufactured.

Let's also try to cram 16MB of memory into the little sucker so it can run OS/2, Windows NT, and Unix. It should also have both a keyboard and mouse port so you can use it with a monitor and real keyboard. Parallel, serial, and Super VGA port should be on the back, too; four PCMCIA slots would be nice. And I'd prefer a built-in V.34 data/fax modem. So add an RJ-11 connector socket.

My ideal notebook is made from a graphite composite shell, weighs about 3 pounds, and runs for 5 hours.

Let's try and make the whole notebook (sans floppy disk drive) weigh in at 3.5 pounds. And make sure to use a modern battery charger, one of those Zippo lighter-size puppies for 5 hours of battery life.

I think this new specification is closing in on notebook perfection. . .but the next one will be even better.

Illustration by Clemente Botelho

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CIRCLE 177 ON READER SERVICE CARD

John C. Dvorak

Inside Track

More Conspiracies Dept.: One of the most interesting deals recently in the news is Microsoft's buyout/merger of Intuit. On the surface, it's hard to see why Microsoft did this. The only explanation that made sense to me was the possibility of the **Justice Dept.** or the Federal Trade Commission quashing the deal, giving Microsoft something to complain about.

Why did Microsoft buy Intuit? Because Gates is a big believer in getting smart guys to work for him. He needs to suck Scott Cook's brain dry. Expect to see Microsoft buy more and more companies for "brain sucking."

I've concluded Microsoft would not only benefit from the government voiding the deal but might actually encourage it. There have been many reports of **Bill Gates playing golf with Clinton.** The Microsoft executives were known for supporting Clinton but not necessarily known for large monetary contributions. If Gates could signal (or just tell) Clinton to **kill the Microsoft/Intuit deal,** he would accomplish three things. (1) As we all know, the recent wimpy rulings against Microsoft angered much of the competition screaming for justice. One newsletter writer is madder than a wet hen. There's lots of bad press. Quashing this deal would **quiet the crowd.** (2) Microsoft has had no luck with its Microsoft Money. In many ways, Microsoft Money is superior to Quicken. **But why beat a dead horse?** Part of this deal means selling the Microsoft Money code to Novell. In other words, Microsoft gets rid of an albatross. If the deal is quashed, Microsoft can **complain** that it was screwed. (3) Now having been screwed, Microsoft can take more leeway in its relations with industry and not worry about government. Microsoft would be seen as a company abused by arbitrary government action.

If the government kills the deal and you suddenly see Microsoft's **generosity towards Clinton** in his reelection bid, you'll see the connection.

Now let's come down to earth and discuss why Microsoft would buy Intuit. First of all, **Microsoft could not compete** head-to-head with a small California software company with a fraction of the resources commanded by Microsoft. One analyst claims that the whole deal was done so Microsoft could get hold of the 6 million Intuit users and somehow **sucker them** into signing on to Marvel, the on-line service that will include personal-finance stuff and, perhaps, on-line banking. This conclusion is **hogwash.** How many of the 6 million Intuit users ever go on-line? Half maybe? So it gets 3 million potential Marvel users for $1.5 billion. Would Microsoft pay $500 a head to pump up the subscriber base of Marvel? I don't think so.

I take Microsoft at its word. The company says that it believes that **electronic banking** is the future, and Intuit has a better track on this than Microsoft. The track was created by Intuit honcho Scott Cook, who is something of a genius when it comes to this market. Gates is a big believer in getting smart guys to work for him. He needs to **suck dry** Scott Cook's brain if he wants Microsoft to be successful in this niche market. That's why Microsoft bought Intuit. Expect to see Microsoft buy more and more companies for "brain sucking."

Colors, Colors Everywhere Dept.: Some time ago, a company called Penor brought out a **stunning** monitor and keyboard combination in lavender, sky blue, and other colors. Anyone who could get hold of these peripherals loved them. I've always thought that colored monitors, computers, keyboards, and mice were the future. The Taiwanese kept trying to introduce colorful devices, but boneheaded American wholesalers **rejected** them and we, the consumers, never got a chance to buy these things.

So my heart skipped a beat when monitor-maker **Nokia Consumer Electronics** introduced a new line of Scandinavian-designed 17-inch monitors in red, blue, green, or granite. The monitors incorporate speakers (Nokia makes speakers for Porsche and Mercedes-Benz) and look like **winners** for the home system.

Genuinely Interesting Software Dept.: There's more from Scandinavia. A lot of you have heard about the public-domain version of Unix from Finland's **super coder** Linus Torvalds. Novell was even going to jump into the scene with a project named Corsair. I've had many hackers and programmers insist that I plug this excellent version of Unix. **The best source** is Yggdrasil Computing (telephone, 408-261-6630; fax, 408-261-6631). The company put together a $34.95 CD-ROM **jammed** with everything you need to run Linux, including the source code and full X Window implementation. This thing incorporates true multitasking and has real TCP/IP support. The newest version of Linux lets you run System 5, Release 4, Unix binaries! This means most **everything** that runs on most commercial Unix boxes should work here, too. For $34.95, there's **no excuse** not to have Linux as a primary or alternative operating system on your workstations. Yggdrasil is the leading provider of this stuff in the country. If you have any interest in Unix, you should **call these guys now.** Oh, the name refers to some mythological Norse tree. They'll be glad to explain it. **Highly recommended.** Bargain of the year. □

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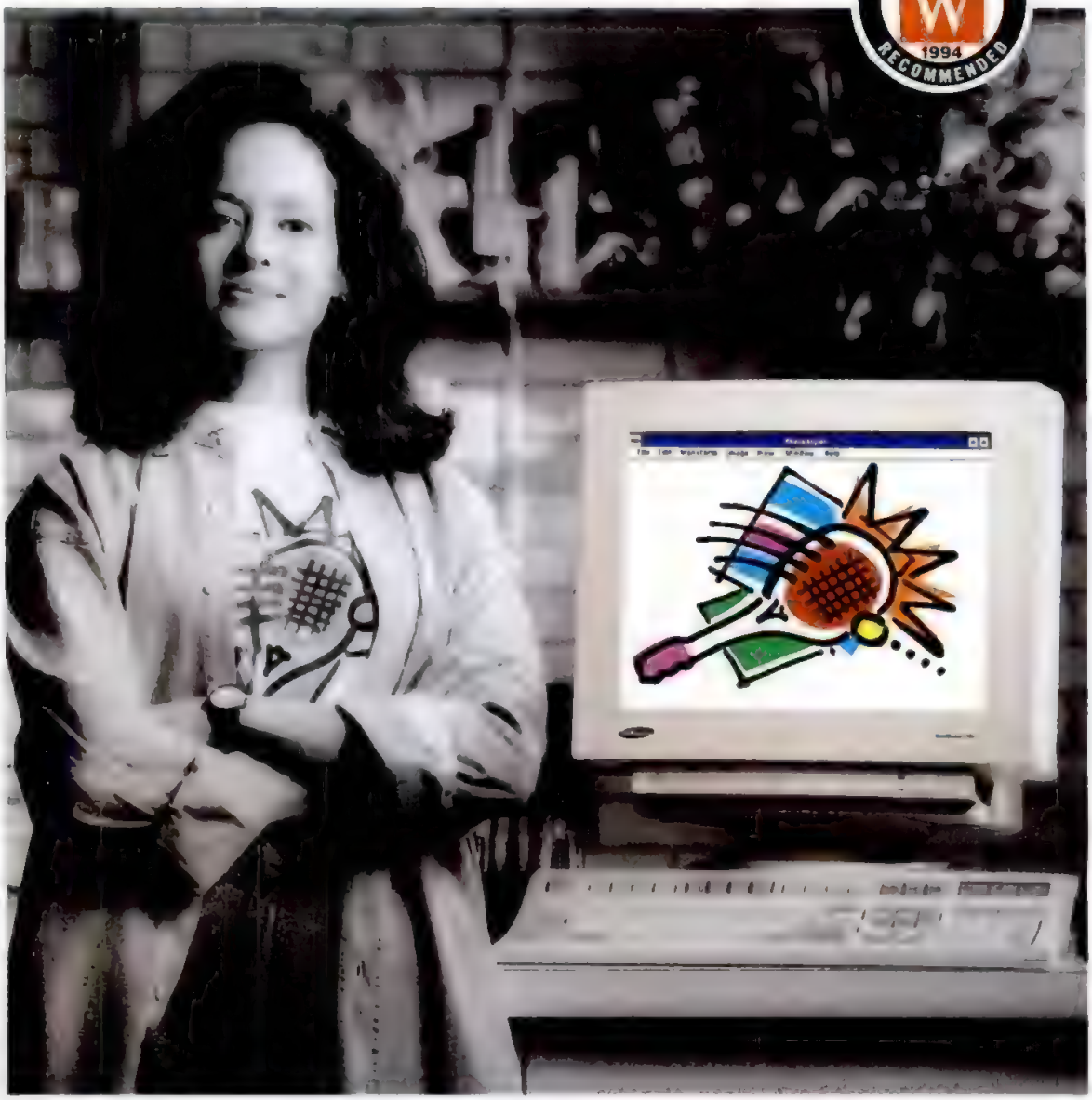

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Jim Seymour

PC Sound: Upping the Ante

Earlier this year (in our April 26 issue), I looked at some of the amplified speakers sold for PC sound use and made a few suggestions about which work best in typical PC setups. Since then, three things have happened: Many new and often much-improved PC speakers have appeared on the market; sound itself has gotten both more important and a good deal better on new CD-ROMs; and a large number of readers have written me with their tips and tricks for getting better sound out of their PCs.

Clearly, it's time for us to revisit PC sound.

One problem many users say they worried about before they set up a PC sound system at work was that in an office, their coworkers might find the sound intrusive. In practice, this rarely becomes an issue. The laws of physics come to our rescue here: Sound falls off at the square of the distance from its source—twice as far away, it's only one-fourth as loud. So, unless you're sharing a desk or cubicle with someone, you're not likely to bother anyone if you keep the volume at a moderate setting.

Both the fear of disturbing others and a desire for privacy lead many PC users to try earphones. In my earlier column, I suggested users try the inexpensive headsets that come with portable cassette players, but since then I've used several really exceptional wireless headphones, which are a lot more practical.

Even the least wriggling in your chair or reaching for the telephone gets you tangled up in headphone cords; a cordless setup is the answer. Sony has several good wireless units in the $100 to $150 range; even better systems from Beyer Dynamik and Sennheiser can be had for $150 to $200.

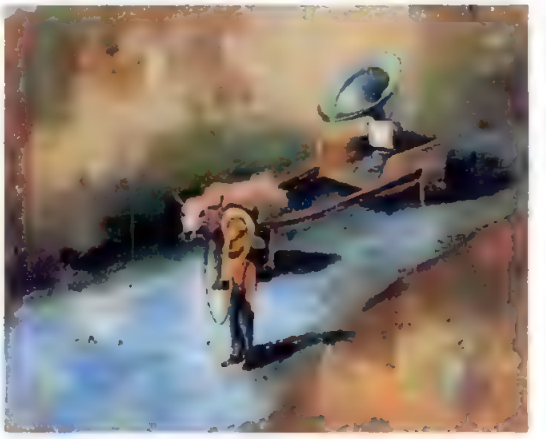
At home you may prefer the design that completely covers your ears, sealing out the sound of the dishwasher, the TV in the next room, and Junior's fights with Susie. But for the office, I recommend the lighter and more comfortable sort of headphone that sits on your ears and allows you to hear ringing telephones and questions from your nearby coworkers.

In the quest for the cheapest decent speakers, one reader had a great idea: Try a boom box. Some of the more elaborate boom boxes have line-in jacks for attaching an audio CD player; just connect the line output from your PC's sound card to the line-in jack from the boom box. If you can mount your boom box on a shelf just above and behind your PC, you can get reasonable PC sound without spending a cent.

STANDOUT SPEAKERS

I know I said this in April, but it bears repeating: Deep-six the tiny, tinny boxes that come bundled with your multimedia PC. How much you spend on replacing them depends on how much you value good sound and how loud you're likely to play the system.

For home, or for an office where you can crank up the volume after hours and let your system wail, two really exceptional new amplified systems are available from Bose Corp. and Cambridge SoundWorks. Both move the low-frequency driver, along with the amplifier, into a separate subwoofer unit.



PC sound has come a long way since the days of crackly 8-bit sound boards and cheesy squawk boxes.

Bose's entry, the Acoustimass Multimedia Speaker System, uses two tiny satellites—about 3 by 3 by 4 inches (HWD)—that sit behind and on either side of your monitor; the big, heavy subwoofer sits on the floor.

I think I can safely say that this offers the best PC sound you've ever heard. The midrange and treble are smooth and crisp, and the bass coming from that subwoofer is nothing less than astonishing. Sometimes late at night I close the door, pull down the shades, crank up the Bose-equipped PC in my study, and dive into

Illustration by Clemente Botelho

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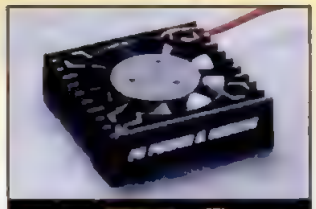

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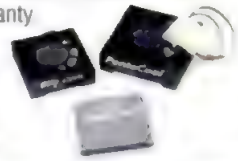

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Jim Seymour

LucasArts Entertainment Co.'s Rebel Assault. Being surrounded by so much good sound literally changes the experience of a computer game: You're inside the game, not just an observer.

The Bose system costs about $600—but you get what you pay for. If you want the best, nothing can touch the Acoustimass system.

The best buy in new PC sound systems has to be Cambridge SoundWorks' eponymous SoundWorks. At $199, SoundWorks approaches the sound quality and volume of the Bose, at a third of the price. Its tiny cubes are about the size of the Bose satellites, but the subwoofer is much smaller. The sound is crisp and clear; as with the Bose system, you may have to listen to a high-quality music CD to appreciate just how good SoundWorks is.

THE PAST, REVISITED

Altec Lansing, which introduced separate subwoofers in PC sound, has revised its ACS 300 system (now called the 300.1), cleaning up its sound considerably in the process. The distortion I heard before in the 300s is now gone.

Among the speakers recommended previously, the Yamaha YST-M10s ($70, street) are now probably the overall value leaders, with good sound at a great price. The $90 AR 22s from the Acoustic Research division of International Jensen, which I recommended as the best really compact speakers, still win that prize (unless, of course, you can move up to a subwoofer system, such as the Bose and Cambridge SoundWorks units).

Finally, there's a new development in PC sound that will really appeal to game players: so-called "3-D" sound.

By far the best 3-D results I've heard come from NuReality's add-on SRS units. The $80 Vivid 3-D Plus unit plugs in between your sound card and speakers and makes a *huge* difference in the impact of game sounds. With this gizmo, your audio world opens up spatially—suddenly you're inside the game. Combined with powerful, wide-range speakers, an SRS system delivers a gamer's nirvana.

PC sound has come a long way since the days of crackly 8-bit sound boards and cheesy squawk boxes. If you're still stuck in those dark ages, this Christmas may have a nice surprise in store for you. □

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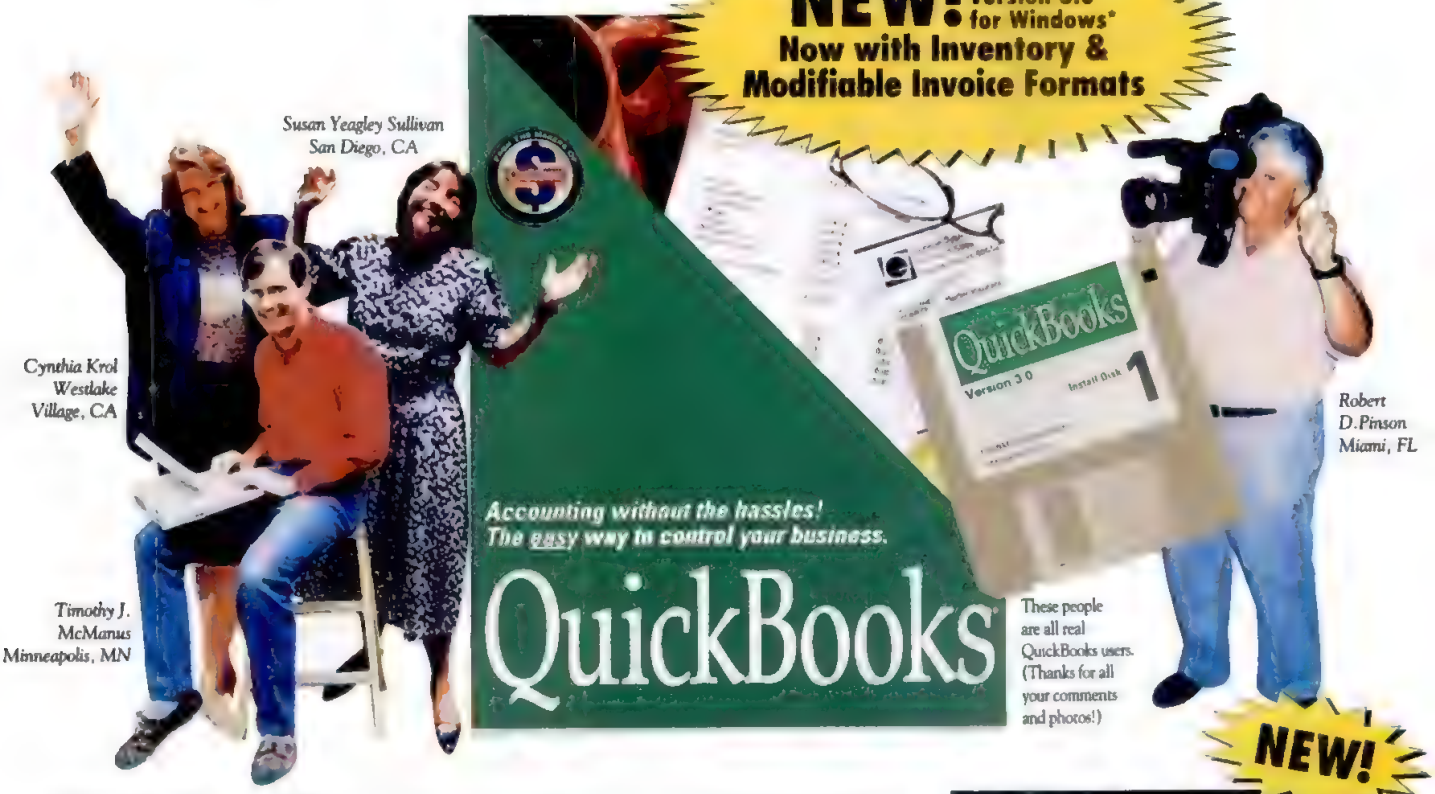

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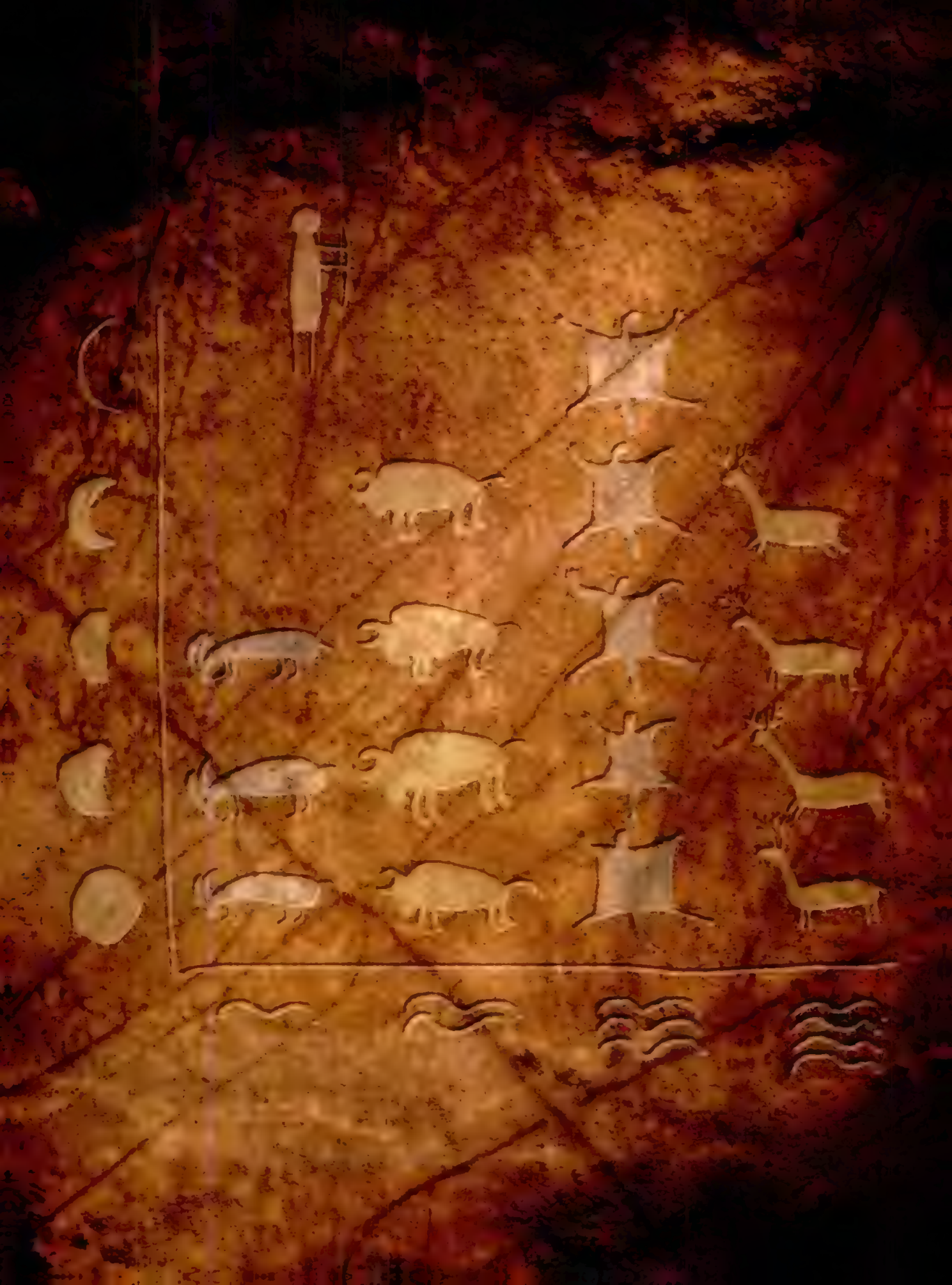

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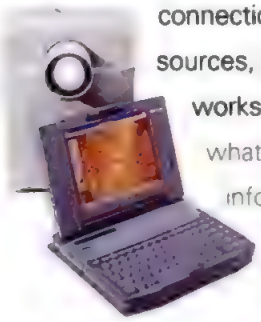

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Sincerely
Frank
yes
no
AT&T
to Steve Fisher
from Frank Shuford
about meeting Mon 12/5
tap for details
Kelly,
The plane's leaving on time (surprise, surprise) I'll be in at 3:00 to go over your (terrific) ideas. Let me know if that's ok.
Frank
F·A·X
to Kelly Tobin
from Frank Shuford
about Meeting
Dear Patrick
Hey, I know you're tied up on that project, but you gotta come up for air sometime! Like maybe for the hockey game of the century—tonight, 8pm, two-tix, center ice, on the glass? Get back to me, okay?
Frank
SkyTel
to Patrick Vogt
from Frank Shuford
about Time-out
SONY
Magic Link
CIRCLE 079 ON READER SERVICE CARD

Bill Howard

My Perfect PC

My PCs at home and in the office are showing their age, and I've started thinking about what I want on my desktops for the next few years. While brand is important, I don't think you'll find enough performance difference among vendors to make you choose A over B because A ships a faster Pentium box. Brand-versus-brand performance differences are huge among servers, noticeable among portables, but only secondary among desktops. Here are some of the features I'll be looking for.

• **Mini-tower case.** For me, towers are overkill, and standard desktop units don't have enough room for expansion.

• **Pentium/90 CPU.** Anything less doesn't save enough money to be worth considering. Pentium/60s may be fast enough, but they run too hot, and they can't idle at low power. Much as I have public doubts about Energy Star, I personally want it because I'm the one in a hundred who actually does want to receive faxes in the middle of the night. If I were willing to wait until early 1995, I'd be happy with a low-power Pentium/75.

• **256K secondary cache, 16MB RAM.** Without a decent CPU cache and sufficient system memory, you're tossing away millions of instructions per second. PC Labs' testing shows that real performance advantages begin at 12MB of RAM, so 16MB gives you a margin of performance safety.

• **Internals, I/O.** The bus would be PCI, with ISA for slower accessories. I'd also get a PCMCIA adapter; it's going to be useful within the year. I'd look for a unit with an infrared transceiver meeting the IrDA specification that's become the industry standard; it'll make laptop data transfer a joy. And I would like an internal modem that meets the new V.34 (28.8-Kbps) standard, but until drivers for my communications and e-mail software are available, I'll settle for a V.32bis (14.4-Kbps) modem. I'd get built-in Ethernet (10BaseT) even for my home PC because even home PCs are going to be networked shortly.

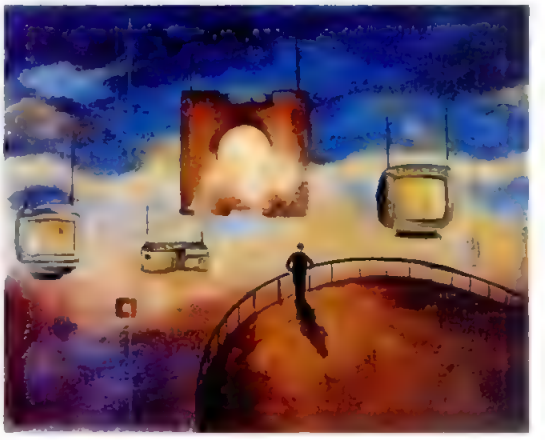
• **17-inch monitor,** stable graphics adapter. I'd want a 21-incher, but that's $2,000. Multiple windows demand 1,024-by-768 resolution, and 15 inches is just too small. I'd drive it with whatever PCI graphics adapter is currently fast and stable, with 2MB of RAM. I'd also look for a simple but effective color-matching scheme such as Sonnetech's Colorific.

• **Mass storage.** I'd install a 1GB hard disk with an E-IDE interface. The CD-ROM drive would be a quad-speed six-disk changer; at the very least I'd get a quad-speed single drive and a cheap double-speed drive so I could have two CDs always loaded. As an old-timer with several hundred 5.25-inch floppies kicking around, I'd get a dual-media floppy disk drive. I know I should have tape backup, which means DAT for a drive of this size or maybe the new DC-3010–spec drives, but I back up every data file to my laptop every day already, and I'm waiting for $1,000 CD-ROM drive/recorders to show up in mid-1995.

• **Multimedia.** I'd get a wavetable sound board, probably from Turtle Beach (they really are in a performance and price class by themselves). I personally don't care about Sound Blaster compatibility because I've vowed not to buy any more games for the kids if they don't run under Windows, where it's a moot point. DOS games are too ill-behaved. I'd also throw away the underachieving courtesy speakers bundled with my system and buy three-way amplified speakers with a subwoofer that doubles as an ergonomic footrest.

• **Bells and whistles.** Reset switch. Silent keyboard (no click). Cordless mouse. Switched power outlet for monitor on system unit. A 400– to 600–volt-amp uninterruptible power supply with surge protection.

Last, given how much time I spend in front of the computer, I'd invest several hundred dollars in a comfortable chair and buy a computer desk with a 26-inch—not 30-inch—typing height. □



Buying a PC is a personal process. Here's one buyer's checklist of the right stuff.

Illustration by Clemente Botelho

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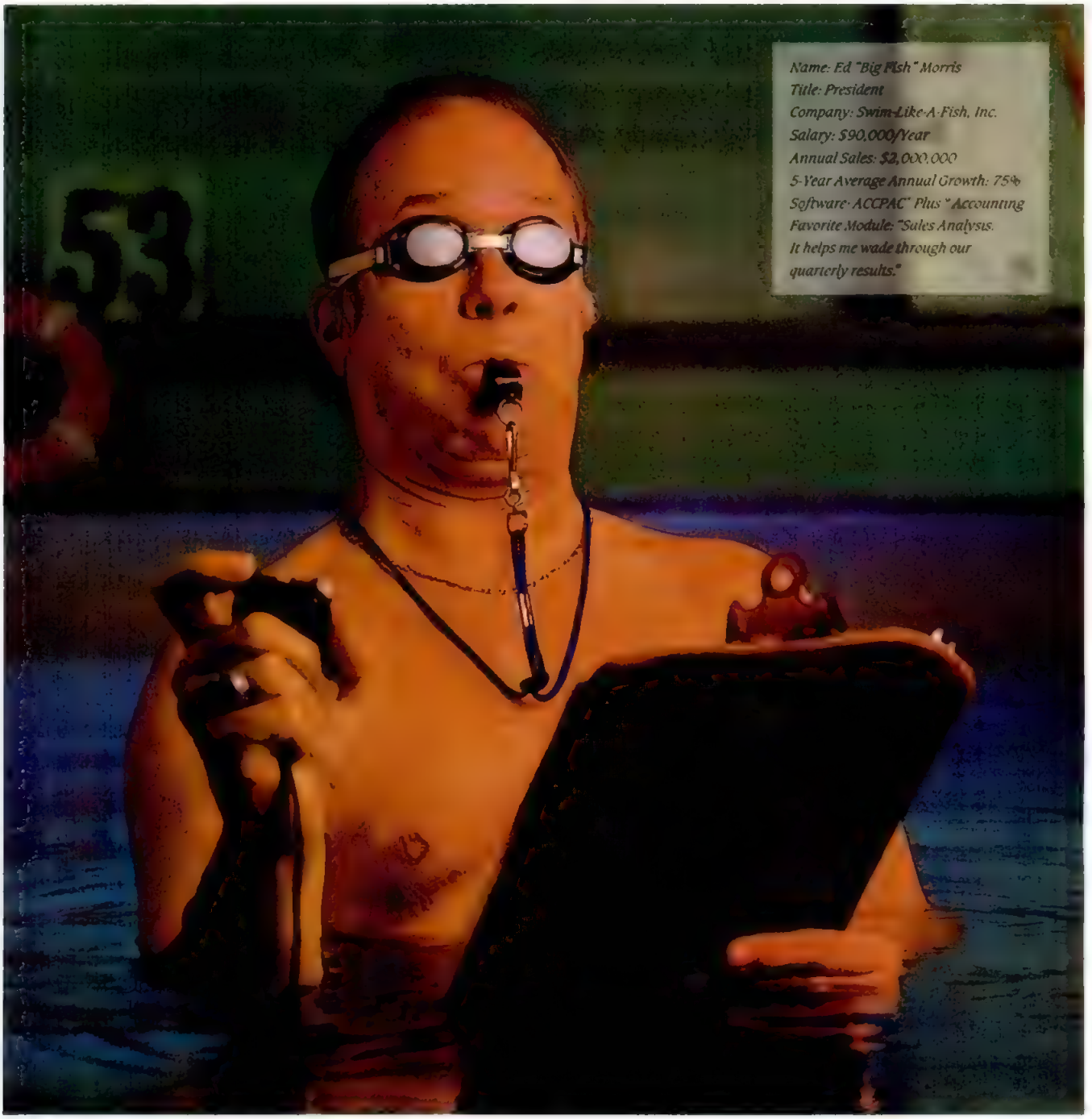

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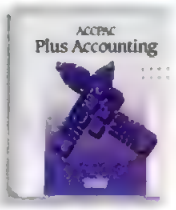

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THE 11th ANNUAL AWARDS *for* Technical Excellence

BY MICHAEL J. MILLER

THE PC INDUSTRY HAS COME A LONG WAY FROM THE JANUARY 1975 issue of *Popular Electronics* that featured the Altair 8800, the first recognizable personal computer. In the 20 years since then, we've seen PC power and usability grow by many orders of magnitude, driven by a constant stream of technological innovation.

As we gather electronically over our PCs to determine the winners of *PC Magazine*'s 11th Annual Awards for Technical Excellence, we take stock of just how far we have come. In the pages that follow, we look at the computer industry milestones of the past 20 years that have brought us to the present. Then we move on to the winners and finalists of this year's Technical Excellence awards. Finally, our editors indulge in a fit of crystal ball gazing to try to spy out where the computer industry will be heading over the next few years.

Photography by Thom O'Connor

Where it all began: The January 1975 cover of *Popular Electronics* featured the Altair 8800 kit, the first recognizable personal computer. Your $400 bought you a do-it-yourself 8-bit Intel 8080-based system with 256 bytes of RAM. You entered in machine code using front-mounted switches and read binary output off the front-mounted LEDs. Serious nerds could add a CRT, a keyboard, and memory expansion cards ($34 for an extra 256 bytes). Later that year, you could also add a BASIC interpreter written at a company called Micro-Soft by a teenager named Bill Gates.

◄ In 1983, IBM's souped-up PC-XT used a 4.77-MHz 8088 chip and premiered a 10MB hard disk.

◄ By April 1977, Steve Jobs and Steve Wozniak had already left the garage for grander surroundings. The Apple II, selling for about $1,300, shipped with 4K of RAM and a jack to use your TV as a monitor. A year later, the Apple II+ added a floppy disk drive.

► The IBM PC AT, a 6-MHz 286 system launched in August 1984, brought a number of innovations including a 16-bit expansion bus. With 512K of RAM, a 20MB hard disk, and a monochrome monitor, this baby sold for a whopping $5,795.

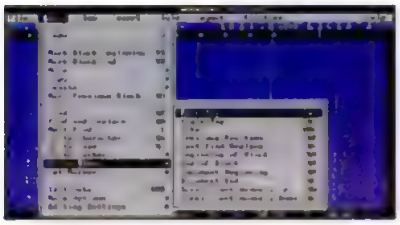
◄ Big Blue gets into the act. In August 1981, IBM launched the original PC, based on Intel's 8088. With two floppy disk drives and a monochrome monitor, it cost about $3,200. Microsoft cut a deal to supply the operating system (DOS), reserving the right to sell it to any interested third parties. IBM predicted modest sales.

► The Tandy/Radio Shack (TRS) 80 line, introduced in 1977, later included the Model 100, one of the first true portables. This 32K model was light, got about 4 hours from four AA batteries, and offered a very robust ROM-based BASIC and a built-in modem.

▲ Remember the luggables? Starting in 1983, systems like the rugged Compaq Portable gave powerful computers a mobility they'd never known before.

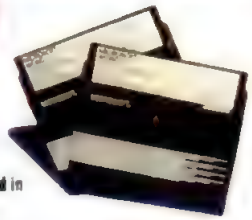
▲ PC DOS 1.0, a 160K floppy, shipped with the first IBM PC in 1981. Microsoft is reported to have acquired the core code from a Seattle developer for $75,000.

► The first issue of *PC Magazine* (all 96 pages of it) hit the stands in February 1982. Need we say more?



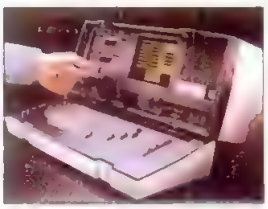
▲ Who can forget the control diamond introduced in the 1978 WordStar? Even in this latter-day WordStar version (7.0), they all still work.

▲ Kaypro offered a CP/M system with a built-in CRT in a bullet-proof carrying case. The craze peaked around 1983, when the Kaypro II sold for about $1,800.



▲ Lotus 1-2-3, first released in 1982, picked up where older packages like VisiCalc left off. It fast became the number-cruncher's killer app. Was that /FR?

► The Osborne 1, a Z80-based CP/M machine with 64K of RAM and a built-in 24-line CRT, arrived in 1981. But sales dried up while fans waited for its successor, the Osborne Executive (shown). The Exec never shipped in volume, and the company went under.

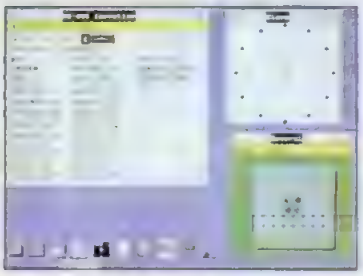


▲ Microsoft Word 1.0, one of 1983's less spectacular entrants, showed Microsoft's rising interest in the applications software market.

▶ In 1987, the 80C88-based Toshiba T1000 set new standards in miniaturization.

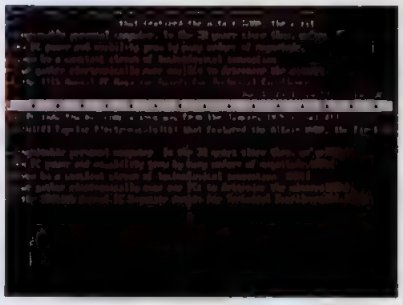
▶ The GUI avalanche on the PC began with Windows 3.0 in May, 1990. Microsoft claims that some 40 million PCs now run its successor, Windows 3.1, released about 18 months later.

▶ IBM tried to take back control of the PC market in April 1987 with the PS/2 family of PCs. These included nonstandard Micro Channel architecture and a new operating system called OS/2. The proprietary technology was impressive—but the strategy was a disaster. Buyers stayed away, and in some ways, IBM has never recovered.



▲ Microsoft Windows 1.0 (released in November 1985), Windows 2.03 (shown), and Digital Research's GEM demonstrated the PC world's realization that graphical Mac-style apps like Aldus PageMaker could run circles around DOS.

▲ In the early 1990s, the direct market, spearheaded by companies like Dell, Gateway 2000, and Zeos, grew to massive size by offering great deals. Buyers got sound components, flexible configurations, decent support, and low prices. They also got cutting-edge technology.



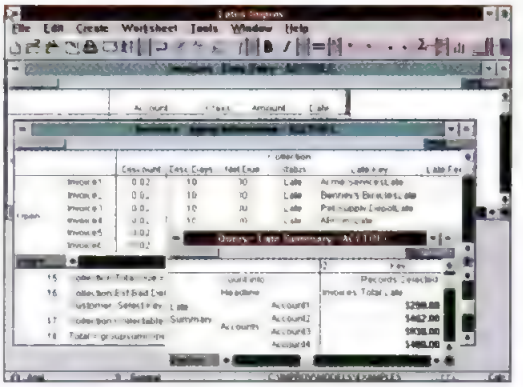
▲ WordPerfect 4.2, released in 1987, was the all-time most successful word processor, not least because of its famous clean screen.

▲ In September 1986, Compaq beat IBM to market with the Deskpro 386, the first 80386-based PC. Soon, clone manufacturers great and small were showing that they could beat IBM at its own technology game.

▲ OS/2 1.1, introduced in October 1988, added the graphical Presentation Manager to IBM's 16-bit protected-mode operating system.

◀ In 1989, you'd pay $5,599 list for the Zenith SuperSPORT 286, a classic clamshell that gave you a 12-MHz 286 CPU and 40MB of disk storage.

'86 '88 '90



▶ Lotus's revolutionary Improv, developed on the NeXT computer and ported to Windows in 1993, brought multidimensional analysis and pivot tables to the spreadsheet. Its features were widely copied, but the product couldn't stand on its own and was yanked. Lotus plans to fold it into 1-2-3.

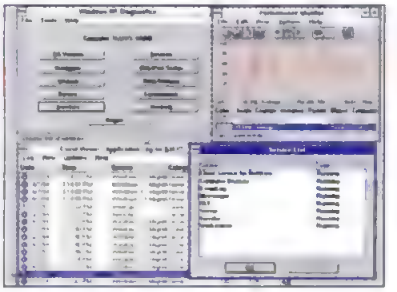
▲ Today, systems like this Hewlett-Packard Vectra XV 5/90C offer a 90-MHz Pentium processor, a huge hard disk, 16MB of RAM, a high-resolution monitor and accelerated graphics for about $3,000 to $5,000. Will systems like this be next year's entry-level machine?

▶ Things just get smaller. The HP OmniBook 300, shipped in 1993, delivered a full-sized keyboard, a 40MB PCMCIA hard disk, Windows 3.1 in ROM, and a little flip-out mouse thing in a sub-3-pound package.

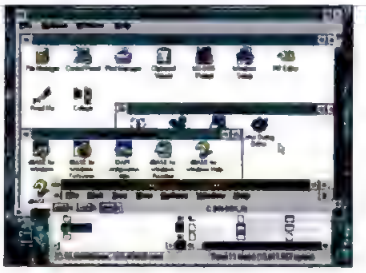
▲ Pen-based PDAs like the new Sony Magic Link point toward the future. But most buyers seem to feel that the future isn't here yet.

▶ Today's suites are more than bundles. OLE integration and common macro languages of the kind found in Microsoft Office Professional, Version 4.3, make them able to act as one.

▶ Windows NT 3.5, released in September 1994, is currently Microsoft's most advanced operating system. Maybe this year we'll get to see Windows 95.



▶ Among today's state-of-the-art spreadsheets, Microsoft Excel 5.0 arguably holds an edge.



▶ IBM's just-released OS/2 Warp, Version 3 continues the company's brave fight against the Windows juggernaut.

'92 | '94 | Today

Application Software

WINNER

Microsoft Office, Version 4.2

The Microsoft Office Development Team

EVERYONE TALKS ABOUT APPLICATION INTEGRATION, BUT MICROSOFT OFFICE, Version 4.2, was the first application suite to deliver it in a real, workable form. The glue that holds the components together is OLE 2.0; the result is that even a novice can learn how to embed and edit an Excel worksheet inside a Word document. The major applications in Microsoft Office—Word 6.0, Excel 5.0, and PowerPoint 4.0—also provide a level of consistency in menu structure and user interface that hasn't been seen before.

Microsoft Office shows the beginning of true, integrated, cross-application macro support, with Excel's native Visual Basic for Applications able to call Word functions and pass data to Word, for example. Certainly we can imagine improvements to OLE and to macro languages, but for now, Office has set the standard that other suites will have to meet. By validating the suite concept and showing how its components can work together, Office will have a lasting impact on how the general productivity applications are priced, packaged, and published.

▶ *Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400.*

FINALISTS

Collabra Share, Version 1.0

Alastair Dallas, David Mease, David Christie, Jeff Winner, Lisa Chiang, Greg Potter, Jim Black, Spencer Blish, Robert Case, Mike Weston, Japheth Ko, John Friend

COLLABRA SHARE, VERSION 1.0, TAKES THE FIRST STEP toward making intelligent structured discussions easy in a corporate setting. Discussion databases aren't new, but Collabra Share was the first to run such a database over your mail system. It leverages your existing network and communications infrastructure and works with mail systems from different vendors. Even users without the software can participate in discussions being held in Collabra Share by having messages sent to them via gateways to services such as cc:Mail, MCI Mail, or the Internet.

The Collabra Share database can be queried by any user on any mail system, and it supports OLE for integration with other applications. By bringing discussion databases to a wider audience, Collabra Share extends the reach and power of our communications.

▶ *Collabra Software Inc., 1091 N. Shoreline Blvd., Mountain View, CA 94043; 800-474-7427.*

Microsoft Word 6.0 for Windows

The Microsoft Word for Windows Development Team

MICROSOFT WORD 6.0 FOR WINDOWS MAY BE THE BEST example of where application software is heading: toward built-in intelligence that's good at guessing what it is you're trying to do. Word will format your documents for you and teach you the basics of using styles so that you can create even better-looking documents. It will correct your errors as you type, taking the old lookup feature a natural step further. And, of course, it has tremendous customization features, as well as the power of the WordBasic macro language with its links to Microsoft Visual Basic. But perhaps its most impressive feat is the way Microsoft integrated all these rich features together so that you can do what you want as easily as possible.

Version 6.0 is clearly an evolutionary rather than revolutionary enhancement of this venerable product. As an example of the best trends in current software, it raises the word processing species to a new plateau.

▶ *Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400.*

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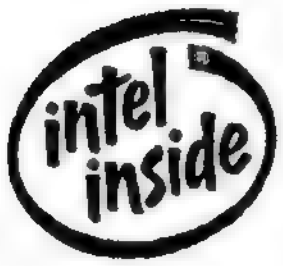

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Hardware

WINNER

Toshiba Portégé Series

Nobuyuki Tanaka, Kyoji Hayashi, Kenji Hibi, Gary Elsasser

PC VENDORS OFTEN TALK ABOUT HIGH-POWERED SUBNOTEBOOKS, BUT Toshiba was the first to deliver a machine that put the features you want into a package that's the size you want.

Toshiba's Portégé T3400 blazed a trail by packing a 33-MHz 486 processor, a great display (one model featured an active-matrix color screen), local-bus video, a 120MB hard disk, and a PCMCIA Type II slot into a 4-pound, very portable, very elegantly designed package.

The first portable with a lithium ion battery, it offers terrific transcontinental battery life. Add to it extras such as Toshiba's vaunted resume mode, a compact external floppy disk drive, and little touches such as a fold-down, slide-in port cover and a miniaturized AC adapter—and the result is nothing short of a small miracle.

The Portégé T3400 has since been superseded by the newer Portégé T3600CT, which features a larger screen and a faster 486DX2 processor.

▶ *Toshiba America Information Systems Inc., 9740 Irvine Blvd., Irvine, CA 92718; 800-334-3445.*

FINALISTS

RealMagic

Julien Nguyen and the RealMagic Design Team

AS MULTIMEDIA ADVANCES FROM CURIOSITY TO COMmonplace technology, the latest quest is to bring digital video and audio to the desktop. Many products, both software and hardware, try to pull this off—but we haven't seen anything that delivers the great video and audio playback of the Sigma Designs' RealMagic board.

The RealMagic board, which plays back video saved using MPEG compression, is based on C-Cube Microsystems' CL-450 MPEG decoder chip. But Sigma Designs did more than just build a board around a good chip. Rather, it modified the C-Cube microcode to make it more attractive to designers of games and other interactive programs. The result is that you can have interactive video as well as superior playback.

Thanks in part to Sigma Designs' success, many other makers of video products are considering adding MPEG support. Indeed, it looks likely that MPEG will become the standard for hardware-assisted video playback. If so, Sigma Designs deserves a lot of the credit for being among the first—and for being so good.

▶ *Sigma Designs Inc., 46501 Landing Pkwy., Fremont, CA 94538; 800-845-8086.*

Tektronix Phaser 440

Howard Goetz, Perry Wingfield, Arlo Kreft, Lynd Wieman, Jim Campbell, Craig Smith, Beth Geever, Chris Shaver, Mike Stevens, Ron Phillips

HIGH-END COLOR PRINTERS HAVE TAKEN SOME TRULY dramatic steps in output quality over the past year, but perhaps the most impressive is the Tektronix Phaser 440. This thermal dye transfer printer offers absolutely the best continuous-tone output of any printer to come through PC Magazine Labs.

Tektronix's entire line of printers is distinguished by the use of resolution-enhancement techniques that result in far cleaner output than the dots-per-inch specifications would suggest. Other vendors have used similar techniques, but few have applied them so well.

The Phaser 440 marries resolution enhancement with thermal dye transfer printing, a technique already known for vivid, highly saturated color. With its great color and clear detail reproduction, the Phaser 440 sets a standard for others to live up to.

▶ *Tektronix Inc., 26600 SW Pkwy., P.O. Box 1000, Wilsonville, OR 97070; 800-835-6100.*

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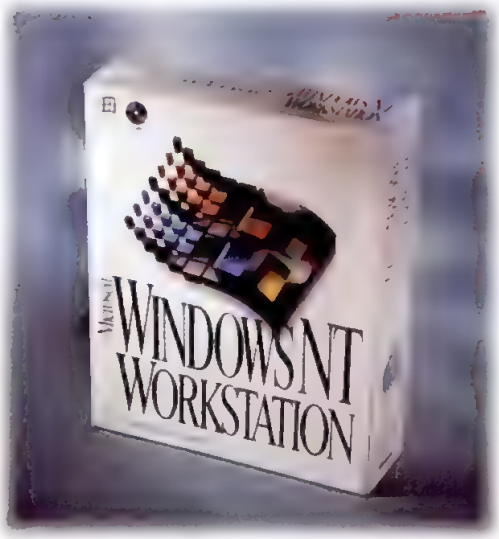
System Software

WINNER

Microsoft Windows NT Workstation, Version 3.5

The Microsoft Windows NT Development Team



MICROSOFT WINDOWS NT WORKSTATION, VERSION 3.5, BETTER KNOWN TO beta testers as Daytona, marks a big advance over Windows NT's previous incarnations. Intended for desktops, the new Windows NT Workstation is smaller and faster and provides better protection for 16-bit applications. It adds Object Linking and Embedding (OLE) 2.0, support for OLE links between separate 16-bit virtual machines, and bidirectional 16-bit to 32-bit OLE. It's also a better network client, offering direct access to NetWare file and printer servers, and better TCP/IP and IPX transports.

While these are important improvements, the most significant advance is the inclusion of OpenGL. This 3-D graphics programming interface, based on a specification originally created several years ago by Silicon Graphics, lets programmers write applications that employ sophisticated 3-D graphics. Under the covers, OpenGL handles hideously complex grunt work like shading and lighting calculations, hidden surface removal, projection transformations, and so on.

Most impressively, OpenGL can work in software only or in conjunction with special hardware, without applications developers having to change their code. This makes it possible for 3-D graphics to work on any machine, though the graphics will run far faster if you have hardware acceleration. The stunning screen savers included with Windows NT are only a foretaste of the 3-D wonders OpenGL will bring forth.

By implementing OpenGL on NT, Microsoft brought workstation-class graphics to the PC, and—finally—genuine 3-D graphics to Windows. In the future, we expect to see OpenGL in both OS/2 Warp and Windows 95. But for now, NT leads the pack.

▶ *Microsoft Corp., One Microsoft Way, Redmond WA 98052; 800-426-9400.*

FINALIST

Magic Cap

Bill Atkinson, Andy Hertzfeld and the Magic Cap Team; and Jim White and the Telescript Team

MAGIC CAP FROM GENERAL MAGIC IS NOT SO MUCH AN operating system for pen-based PDAs as it is a vision of the world as your WAN.

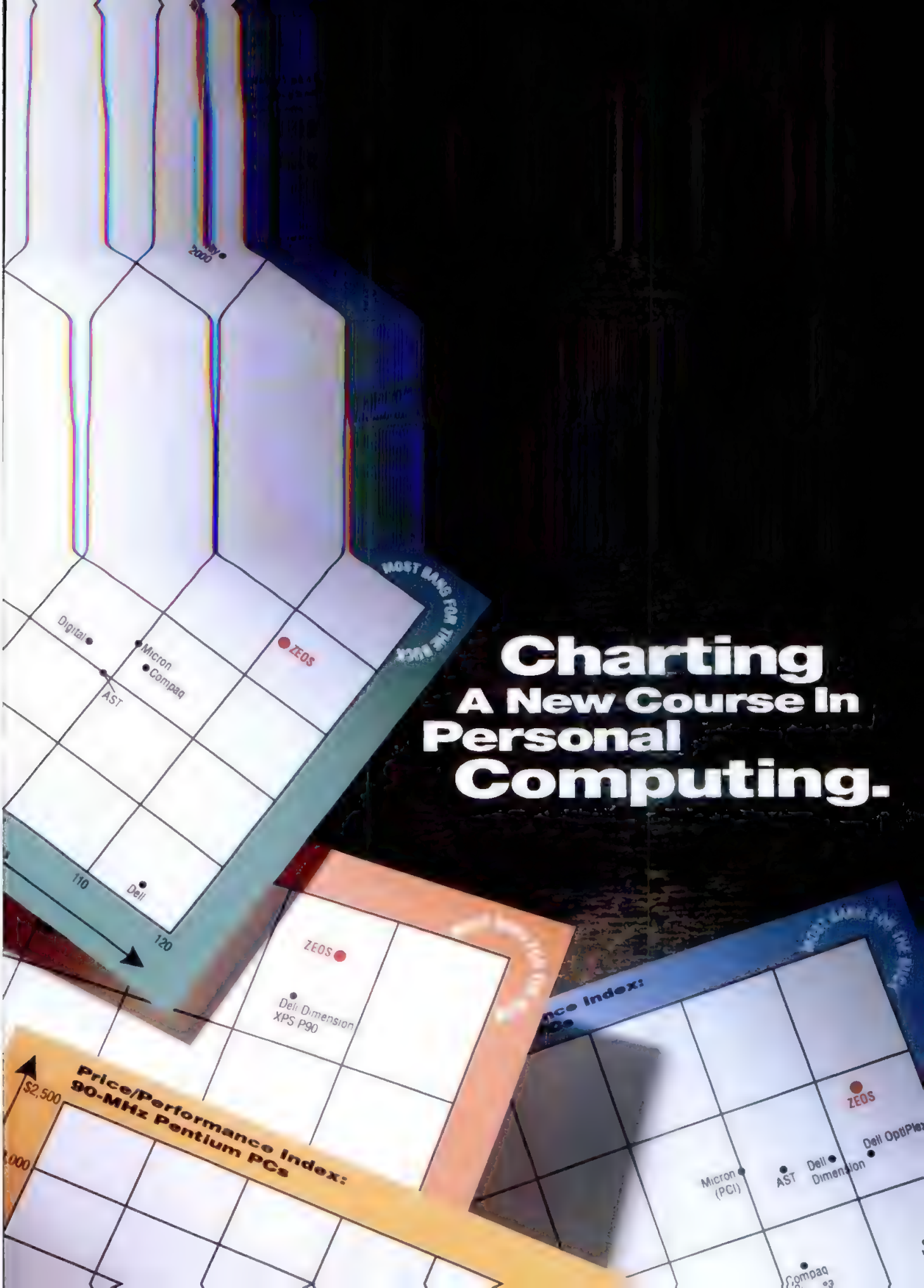
Currently implemented on Sony's pen-based Magic Link Personal Intelligent Communicator, Magic Cap presents you with a graphical desktop on which you find what you need to connect with the rest of the world: an inbox, an outbox, a Rolodex, a calendar, and a phone. Desktop metaphors are nothing new, but Magic Cap's implementation manages to be both accessible and powerful while maintaining a simplicity and elegance that is unparalleled. Navigating from your desk to the library where on-line help and tutorials are stored is just a matter of a few pen taps.

Under the hood, Magic Cap's real power comes from Telescript, a communications language that gives you the ability to send out software agents that operate on your behalf. These agents, which can work on your local system or on remote Telescript-enabled networks, can carry data, execute tasks, and negotiate security barriers. You'll need to customize Magic Cap so that it works the way you do, but in most cases, this is as easy as turning on the rules you want or turning off the ones you don't.

While other operating systems merely refine existing themes, Magic Cap envisions a whole new world where we're all truly connected and where those connections have the intelligence to do our work.

▶ *General Magic Inc., 2465 Latham St., #100, Mountain View, CA 94040; 415-965-0400.*

Charting A New Course In Personal Computing.



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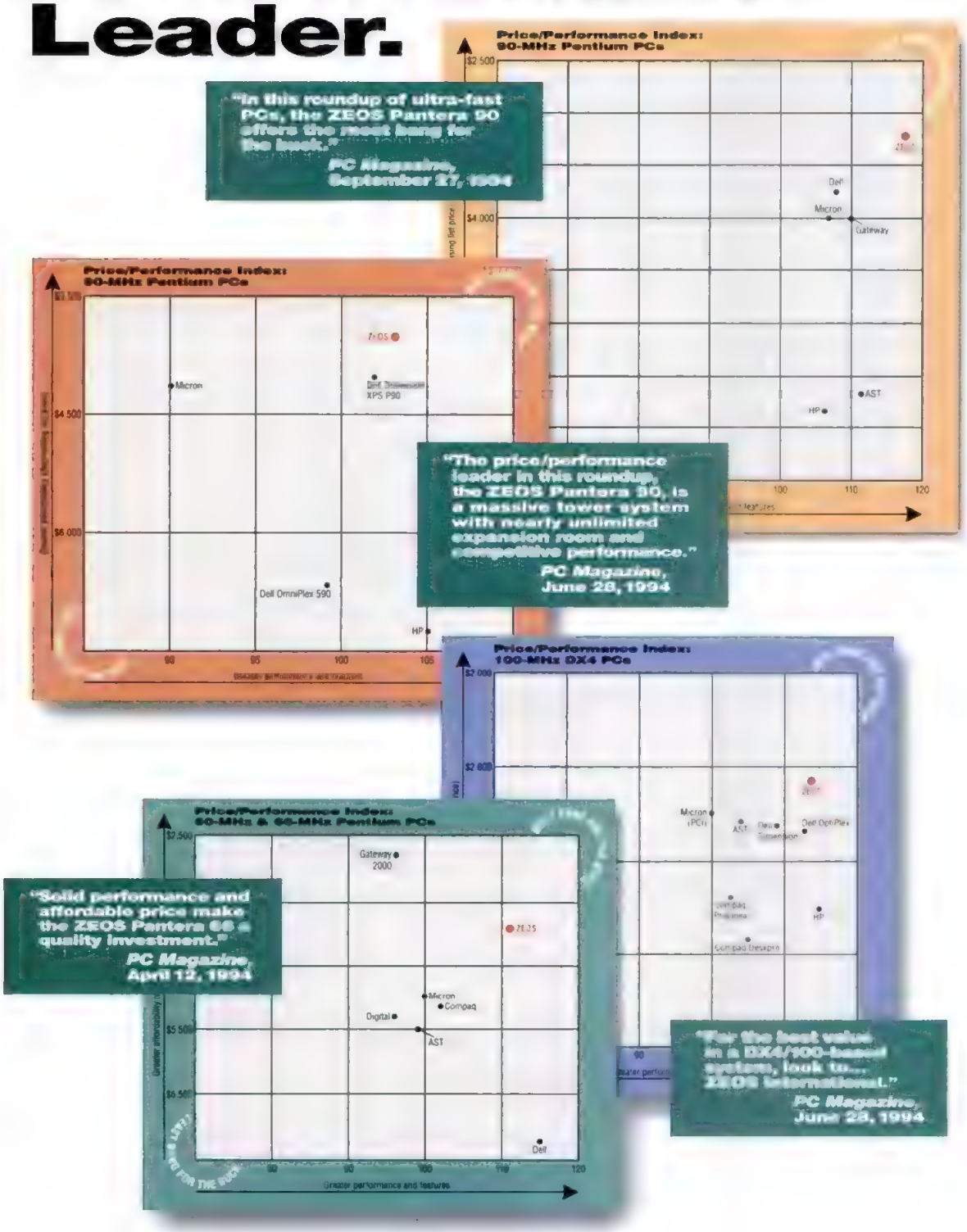

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➤ Six-bay desktop case with two cooling fans		➤ Six-bay desktop case with two cooling fans		➤ Six-bay desktop case with two cooling fans		➤ Six-bay desktop case with two cooling fans	
➤ Microsoft Mouse		➤ Microsoft Mouse		➤ Microsoft Mouse		➤ Microsoft Mouse	
➤ MS-DOS 6.2, Windows for Workgroups 3.11		➤ MS-DOS 6.2, Windows for Workgroups 3.11		➤ MS-DOS 6.2, Windows for Workgroups 3.11		➤ MS-DOS 6.2, Windows for Workgroups 3.11	
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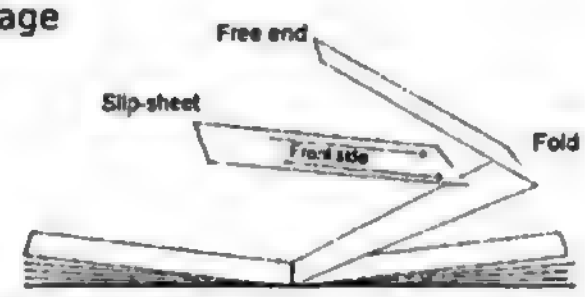
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

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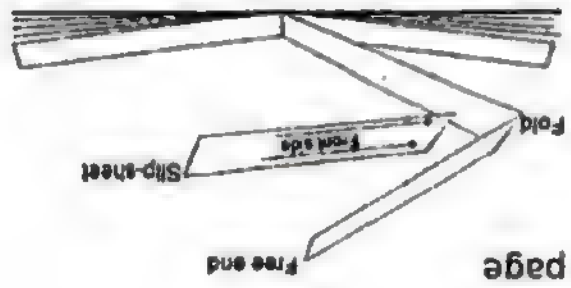
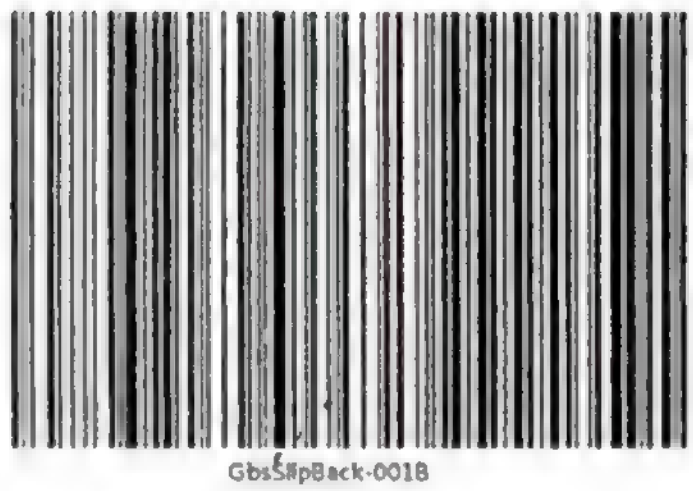
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet





Back

1. Follow instructions on the other side

Inverted Back

1. Follow instructions on the other side

Copyrighted mat

Get The Biggest Bang For Your Buck.

Pentium-66
April 12, 1994
DX4-100
June 28, 1994

Pentium-60
April 1994
Pentium-90
August 1994

486DX2-66
January 1994
February 1994
March 1994
June 1994
December 1994
DX4-100
October 1994
November 1994
December 1994
Pentium-60
December 1994
Pentium-66
June 1994
July 1994
August 1994
September 1994
Pentium-90
August 1994
September 1994
October 1994
November 1994

Pentium-66
May 1994

Pentium-66
June 1994
Pentium-90
August 1994

Pentium-90
November 1994

486DX2-66
March 1994

Time after time, the ZEOS Pantera has been tested against the competition, repeatedly beating all others hands down. In *PC Magazine*'s price and performance comparisons of technologically-advanced systems from primary computer companies, ZEOS is the unbeatable value.

Unmatched in its success, the Pantera is earning award after award—month after month. To date, the Pantera has received an unparalleled 26 top honors from leading industry publications! Experts agree that the ZEOS Pantera provides you with the biggest bang for your buck.

PC World reported: "The ZEOS Pantera 90 is the ultimate Power Desktop. It's lightning fast, beautifully configured, and priced right. That's what power Best Buy is all about."

PC/Computing said: "Rocket-fast performance and a great price make this our favorite Pentium of the lot."

As *Computer Shopper* said: "ZEOS set the standard."

Continuing with the ZEOS tradition of providing you with top performance, unwavering reliability and exceptional value, the ZEOS Pantera is charting a new course in personal computing.

Chart-Topping Performance

The Pantera—based on Intel's 486, DX4 and Pentium processors—is at the top of the performance charts, breaking records and beating all others. Why? Superior engineering built into each Pantera—beginning with a ZEOS-designed motherboard created specifically to take full advantage of the latest technological advancements. The motherboard is stocked with exceptional features such as an on-board PCI Local Bus IDE Controller and support for up to four IDE devices. For the fastest video performance, every Pantera comes with a Diamond Stealth 64-bit PCI video card with 1MB DRAM *standard*.

The results are unparalleled. "Mark a new high on the performance chart!" *PC World* said the Pentium-66 and Pentium-90 Pantera PCs were "the fastest system(s) ever tested." *PC World* also awarded the Pantera DX4-100 a Power Best Buy in October after it outperformed all other DX4 machines, *and* was as fast as many Pentium-90 PCs!

The Pantera 66MHz and 90MHz also received the highest scores in all benchmark tests run by *Windows Sources* too. "The clear winner is the ZEOS Pantera. Its scores were the best across the board."

All Points Covered

The Pantera is a first-rate example of ZEOS' commitment to provide you with an excellent value on an award-winning machine that will increase your productivity. With all the extras, options, and 100% compatibility with all major operating systems, you can't go wrong.

Many of our most popular money-saving Pantera packages are ready to ship *the same day you order.* We also give you the option to custom-design a system to your exact computing needs.

Either way, you can buy with confidence because of our on-going dedication to provide you high-quality features and state-of-the-art technology at an affordable price. As *PC/Computing* said: "...this is a deal you simply can't pass up."

And the value doesn't stop with your purchase. You get the best service and support in the business. ZEOS has won six *PC Magazine* Readers' Choice for Service & Reliability awards. No other company has won more.

Only ZEOS gives you more features standard, incredible expandability, and supreme performance—all at an awesome price. Unequalled in performance, reliability and value, the ZEOS Pantera is the ultimate price/performance leader. To get the biggest bang for your buck, call your ZEOS Systems Consultant today at 800-554-7172.

ZEOS Can Ship Today!

Our most popular packages can be shipped the day you call.* Guaranteed!

486DX2-66 $1845
Pentium-60 $2145

Package #2:

- 8MB RAM
- 528MB local bus IDE hard drive
- 2X CD-ROM drive, 3.5" 1.44MB FDD
- Diamond Stealth 64-bit PCI local bus SVGA graphics card with 1MB DRAM
- 14" SVGA color monitor
- MS-DOS, Windows for Workgroups, Microsoft Mouse

486DX2-66 $2295
Pentium-60 $2595

Top Gun:

The above system modified to include:

- 128K SRAM cache (486) 256K SRAM cache (Pentium)
- Diamond Stealth 64-bit PCI local bus graphics card with 2MB VRAM
- 15" SVGA color monitor upgrade
- 14.4/14.4 send/receive fax modem
- Lotus SmartSuite

486SX-33 $1195

Package #1:

- 4MB RAM, 128K SRAM cache
- 214MB hard drive
- 3.5" 1.44MB floppy drive
- VESA local bus SVGA color video
- 14" SVGA color monitor
- MS-DOS, Windows for Workgroups, Microsoft Mouse

DX4-100 $2840

Editors' 100:

- 16MB RAM, 128K SRAM cache
- 528MB local bus IDE hard drive
- 2X CD-ROM drive, 3.5" 1.44MB FDD
- Diamond Stealth 64-bit PCI local bus graphics card with 2MB VRAM upgrade
- 15" SVGA color monitor
- MS-DOS, Windows for Workgroups, Microsoft Mouse
- Lotus SmartSuite

Pentium-66 $2895
Pentium-90 $3045

Editors' Choice:

The above system modified to include:

- 10-bay vertical case

DX4-100 $3095

Package #3:

- 8MB RAM
- 350MB IDE hard drive
- External 3.5" 1.44MB floppy drive
- STN color VGA 7.8" display
- Custom carrying case
- Extra battery
- MS-DOS, Windows for Workgroups
- Lotus Organizer
- 7.8" x 10.2" x 1.7"; 3.9 lbs.

Pentium-66 $3418
Pentium-90 $3568

Best MM:

- 16MB RAM, 256K SRAM cache
- 528MB local bus IDE hard drive
- 2X CD-ROM drive, 3.5" 1.44MB FDD
- 16-bit sound card, stereo speakers
- Diamond Stealth 64-bit PCI local bus graphics card with 2MB VRAM upgrade
- 17" SVGA color monitor
- 10-bay vertical case
- MS-DOS, Windows for Workgroups, Microsoft Mouse
- Lotus SmartSuite

Pentium-90 $3995

Best MM Supreme:

The above system modified to include:

- 24MB RAM
- 1GB local bus IDE hard drive
- Altec Lansing high-power speakers

DX4-100 $3295

Package #3:

- 8MB RAM
- 350MB IDE hard drive
- Internal 3.5" 1.44MB floppy drive
- Dual-scan color VGA 10.3" display
- Custom carrying case
- Extra battery
- MS-DOS, Windows for Workgroups
- Lotus Organizer
- 8.9" x 11.7" x 1.9"; 6.3 lbs.

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1 Choose the ZEOS system package you want. (A sampling of our *Computers Now!* packages is shown at left.)

2 For same-day shipping, call ZEOS at 800-554-7172 before 1 p.m. Central Time, Monday-Friday.

3 Upon credit approval, we'll ship your system *the same day you order!*

Our Guarantee:

If we accept your order for immediate shipment and fail to ship your system under the conditions outlined, we will ship it *at our expense* as soon as it is ready.*

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We can upgrade your *Computers Now!* desktop or vertical system with a larger monitor—and still ship it the same day you order!*

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*Orders must be for Computers Now! configurations, or we listed just a sampling here. Since we continuously update this list of configurations, please call to confirm your system is on the list. This offer is good only as long as these pre-built systems remain in stock. Other ZEOS systems and custom configurations may take slightly longer—about a week. All orders are subject to credit approval. Monitor upgrades available on all desktop Computers Now! packages. Orders must be received by 1 p.m. Central Time, M-F.

Purchase orders are subject to approval. Business leasing programs available. Lease prices based on a 36-month lease. 10% purchase option. All prices, specifications and availability are subject to change without notice; call to confirm these and warranty details. Prices do not include shipping. Novell compatibility is Developer Tested Dsh. Novell makes no warranties with respect to this product. All products and company names are trademarks or registered trademarks of their respective holders. Intel Inside and Pentium Processor Logos are trademarks of Intel Corporation. ZEOS is a registered trademark. Computers Now! is a registered servicemark. Pantera, Ambra, Pressstyle and ZEOS Meridian are trademarks of ZEOS International Ltd. ©1994 ZEOS International Ltd. 1401 Industrial Blvd. Minneapolis, MN 55413 USA. ZEOS is a publicly traded company (NASDAQ symbol: ZEOS)

PRN PCM 94128

CIRCLE 156 ON READER SERVICE CARD.

Components

WINNER

IBM's magnetoresistive and PRML hard disk technology

Chris Bajorek, Ching Tsang, Mohamad Krounbi, Robert Fontana, Dave Thompson (MR)
Tom Porter, Francois Dolivo, Gottfried Ungerboeck, Jon Coker, Rick Galbraith (PRML)

IT'S NO SECRET THAT HARD DISKS HAVE GOTTEN A LOT FASTER THIS YEAR AND THAT they offer a lot more capacity. These boons are mostly due to advances in the underlying disk technology pioneered by IBM.

One such advance is *magnetoresistive (MR)* head technology, which dramatically increases the number of bits you can pack onto a hard disk (areal density). Unlike conventional drive heads, MR heads have separate read and write elements. While the MR write head works on the same principle as a standard read/write inductive head, the read head is an alloy film whose resistance changes in the presence of flux reversals.

Partial-response maximum-likelihood (PRML) technology combines digital sampling and DSP techniques, allowing more tracks per inch with better head-to-track alignment and narrower track widths. It also allows more data per track with more closely spaced magnetic domains and a significantly reduced read-channel component count.

▶ *IBM Storage Systems Division, 5600 Cottle Rd., Bldg. 097, San Jose, CA 95193; 800-426-3333.*

FINALISTS

Sony lithium ion batteries

The Lithium Ion Battery Team

WE ALL WANT LONGER BATTERY LIFE FOR OUR PORTABLE computers, and the appearance of lithium ion batteries in notebooks is clearly a big step towards getting it. Pioneered by Sony Electronics, lithium ion batteries can offer twice the power capacity of nickel cadmium batteries, enabling lighter portables that run longer.

Sony produced a practicable lithium-based battery by developing carbon-based cathode and anode materials that become reversibly doped with lithium ions during charge and discharge cycles. Sony's lithium ion batteries have been used in cellular phones since 1991. Although we've seen only a few portables with lithium ion batteries to date—notably the Toshiba Portégé and Dell Latitude XP lines—what we have seen has convinced us that we want to see a lot more in the future.

▶ *Sony Electronics Inc., 3300 Zanker Rd., San Jose, CA, 95134; 201-368-9272.*

Enhanced IDE

Rich Rutledge, Shishir Shah, Tom Hanan, Devon Worrell

FOR THE PAST FEW YEARS, HARD DISKS BASED ON IDE (integrated drive electronics) have been the standard on the majority of PCs due to their low cost, respectable performance, and high reliability. But they never quite made it to the high end, where SCSI drives dominated the top of the line because of their higher drive capacities and greater expandability.

Western Digital's new Enhanced IDE (EIDE) drive standard will change the picture. Enhanced IDE supports larger drives (greater than the 528MB limit of IDE) and faster transfer rates; it also allows you to use up to four IDE drives in a system. Just as important, EIDE supports the AT Attachment Packet Interface (ATAPI), a standard for attaching non-hard-disk devices such as CD-ROM drives to the same interface.

Seagate calls the same basic specification Fast ATA. We call it an idea whose time has come.

▶ *Western Digital Corp., 8105 Irvine Center Dr., Irvine, CA 92718; 800-832-4778.*

Networking Software

WINNER

AirAccess, Version 2.0

Richard Thio, Derek Au, Shioupyn Shen

MAYBE WE'RE MASOCHISTS, BUT WE WANT TO BE ABLE TO WORK FROM ANYwhere. AirSoft took a step towards letting us do just that by releasing the first remote-node software designed for packet-radio modems. AirAccess provides full access to network files while customizing the transmissions for the radio link. And it does all of this without regard to the brand of network operating system on the LAN you're calling.

Because AirAccess makes the calling computer a node on the network, it eliminates the need for separate remote e-mail and file-transfer programs. The host software loads on a desktop PC running NetWare, VINES, LANtastic, POWERlan, or any other network client program, so it works in many environments. AirAccess transfers only data that has been changed and uses compression to reduce the amount of data moving across the relatively slow—and expensive—wireless link.

AirAccess gives the Ericsson GE Mobidem and other radio modems a clear and flexible path into LANs and a transmission path for standard network applications.

▶ *AirSoft Inc., 20833 Stevens Creek Blvd., #200, Cupertino, CA 95014; 800-708-4247.*

FINALISTS

NetWare Link Service Protocol

Radia Perlman, Jay Israel, Neal Castagnoli, A. E. Natarajan, Tony Staw, Seyung Oh

LONG-DISTANCE LAN-TO-LAN CONNECTIONS ARE SIMPLY too expensive to use for transmitting administrative overhead messages. But until now, one of the limiting factors in Novell's NetWare has been a design that relies on the transmission of a lot of administrative information—specifically, Service Advertisement Protocol (SAP) broadcasts—which can eat up bandwidth and clog up a WAN. Novell's new NetWare Link Service Protocol (NLSP) reduces SAP broadcasts, freeing bandwidth for other transmissions and making life easier for administrators.

The soundly engineered NLSP software works quietly and effectively to speed LAN-to-LAN communications while letting you hold down your outlay for communications circuits.

▶ *Novell Inc., 122 East 1700 South, Provo, UT 84606-6194; 800-638-9273.*

StarWare NetWare Loadable Module

The StarWare Development Team

TODAY'S LANS ARE BUILT FOR BURSTY TRAFFIC, NOT FOR the heavy, uninterrupted streams of data required for audio and video.

StarWare from Starlight Networks is video server software for NetWare servers designed to overcome this problem. It changes and manages the flow of data within the server to give priority to steady streams of audio and video data. During transmission, the software groups packets together to reduce fragmentation and to lower overhead. The software even recognizes the transmission requirements for different video technologies such as MPEG and Indeo and adjusts to the needs of client computers on the fly. It allows you to set an acceptable minimal level of video and audio service and then manages the number of users and the separate streams of audio and video data to maintain that level of service. This software makes video playback practical in commercial applications.

▶ *Starlight Networks Inc., 325 E. Middlefield Rd., Mountain View, CA 94043; 415-967-2774.*

JetDirect EX External print servers support any parallel-based printer. JetDirect cards support HP LaserJet, HP DeskJet and HP DesignJet printers with I/O slots

NOS compatibility
Novell NetWare, IBM LAN Server, Microsoft LAN Manager, Apple EtherTalk, Apple LocalTalk*, Windows NT, Windows for Workgroups, UNIX: HP-UX, SunOS, Solaris, IBM AIX, SCO UNIX, lpd**

Network compatibility
Ethernet: 10Base-T, 10Base2, Token Ring (4/16 Mbps), Apple LocalTalk*

Multiple protocols with automatic switching

Software management utilities such as HP JetAdmin and HP JetPrint†† for NetWare and UNIX for easy printer installation, remote status and management

Supports SNMP-based network management software

Flash memory for easy upgrades**

Nothing Supports Your Printers Better Than HP JetDirect Print Servers.

Now you can easily connect and manage the printers in your network environment.

If you've been looking high and low for a way to get all your printers on the network, rest your eyes here for a moment. Because the HP JetDirect family of print servers has a solution that works with the printers in your company. Not to mention virtually any LAN environment.

JetDirect cards connect HP printers with I/O slots

JetDirect EX connects any parallel-based printer

And thanks to the software utilities we've included, installation is quick and management of your printers is easy. Plus, you'll enjoy vastly improved printer performance.

Of course, you'd expect all this from Hewlett-Packard, the leader in network printing. So give us a call at 1-800-533-1333, Ext. 8464.† You'll soon discover that when it comes to sharing printers on a network, nothing stacks up to HP JetDirect print servers.

Another smart networking product from HP.

HEWLETT® PACKARD

yes NetWare Tested and Approved

*Not supported by JetDirect EX. **Supported by JetDirect EX fall of 1994. †In Canada, call 1-800-387-3867, Dept. 8464. ††Supported with Netware only. Microsoft is a U.S. trademark and Windows is a trademark of Microsoft Corporation. UNIX is a registered trademark in the United States and other countries, licensed exclusively through X/Open Company Limited. ©1994 Hewlett-Packard Company.

Networking Hardware

WINNER

Xircom CreditCard Ethernet+Modem

The LAN/WAN Development Team

THE LAST THING YOU NEED WHEN YOU'RE TRAVELING IS YET ANOTHER CONNECTION widget to cram into your luggage. A single device that lets you connect to an Ethernet network, check e-mail, and exchange faxes when you're on the road is every every mobile user's dream. Xircom has brought this dream closer to reality with a PCMCIA card that's an Ethernet adapter, a data modem, and a fax modem.

How does Xircom do it? With clever engineering, including the placement of key parts into a layout that meets FCC requirements for telephone connections and IEEE standards for network connections. The layout also includes software drivers that are designed to get out of each other's way when you switch between LAN communications and telecommunications.

PCMCIA, for all its flaws, is a fascinating technology that only hints at how small external peripherals will get in years to come. By putting your modem, your fax machine, and your LAN connection on one card, Xircom has set a new standard of convenience for portable users.

▶ *Xircom Inc., 26025 Mureau Rd., Calabasas, CA 91302; 800-438-4526.*

FINALISTS

EtherWave technology

Mel Aden, Brian Delaney, Joseph DuVivier, Diane Ely, John Marum, Michael "Tex" Prescher, Karen Quastler, Hal Webber

EVERYBODY KNOWS THAT 10BASET NETWORKS NEED wiring hubs to work. Or, up to now, that's the way things were. Farallon's EtherWave transceivers and adapters change the picture by allowing you to daisy-chain up to eight network devices, effectively forming an Ethernet network without a hub. They also let you connect a seven-node workplace LAN to a single 10BaseT hub port—all while keeping compatibility with the IEEE 802.3 specifications.

EtherWave adapters are compatible with adapters from other manufacturers. And you can buy EtherWave products for PCMCIA, ISA, and Macintosh computers, so nobody gets left out. With its elegant EtherWave technology, Farallon has negated some common wisdom and given us a lot more flexibility in network wiring.

▶ *Farallon Computing Inc., 2470 Mariner Square Loop, Alameda, CA 94501-1010; 510-814-5000.*

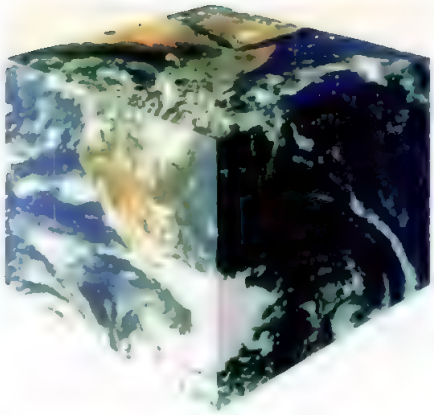
Grand Junction FastSwitch 10/100

The FastSwitch Development Team

GRAND JUNCTION WAS THE FIRST TO MARKET WITH FAST Ethernet, which increases the maximum Ethernet throughput rate from 10 megabits per second to 100 Mbps. Its FastSwitch 10/100 hub—a dream come true for workgroups that require high bandwidth—has a 100-Mbps full-duplex port and an adapter for the server connections. It provides 100-Mbps throughput to servers and 10-Mbps throughput to each client.

Switching is the most economical way to improve the data-carrying capacity of an Ethernet network. But adding switching can simply move bottlenecks from the hub to the server connection. Grand Junction opened that bottleneck with high-speed, full-duplex Ethernet switching technology, letting you sustain 10-Mbps data streams that can exceed an aggregated 100 Mbps across the network. Grand Junction has broken the ground for a new level of performance in local area network connections.

▶ *Grand Junction Networks Inc., 47281 Bayside Pkwy., Fremont, CA 94538; 800-747-3278.*



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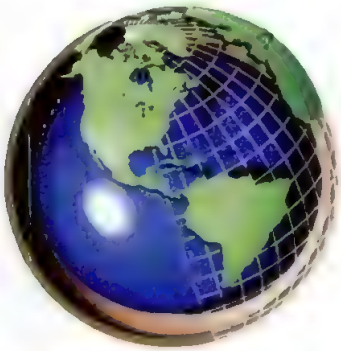

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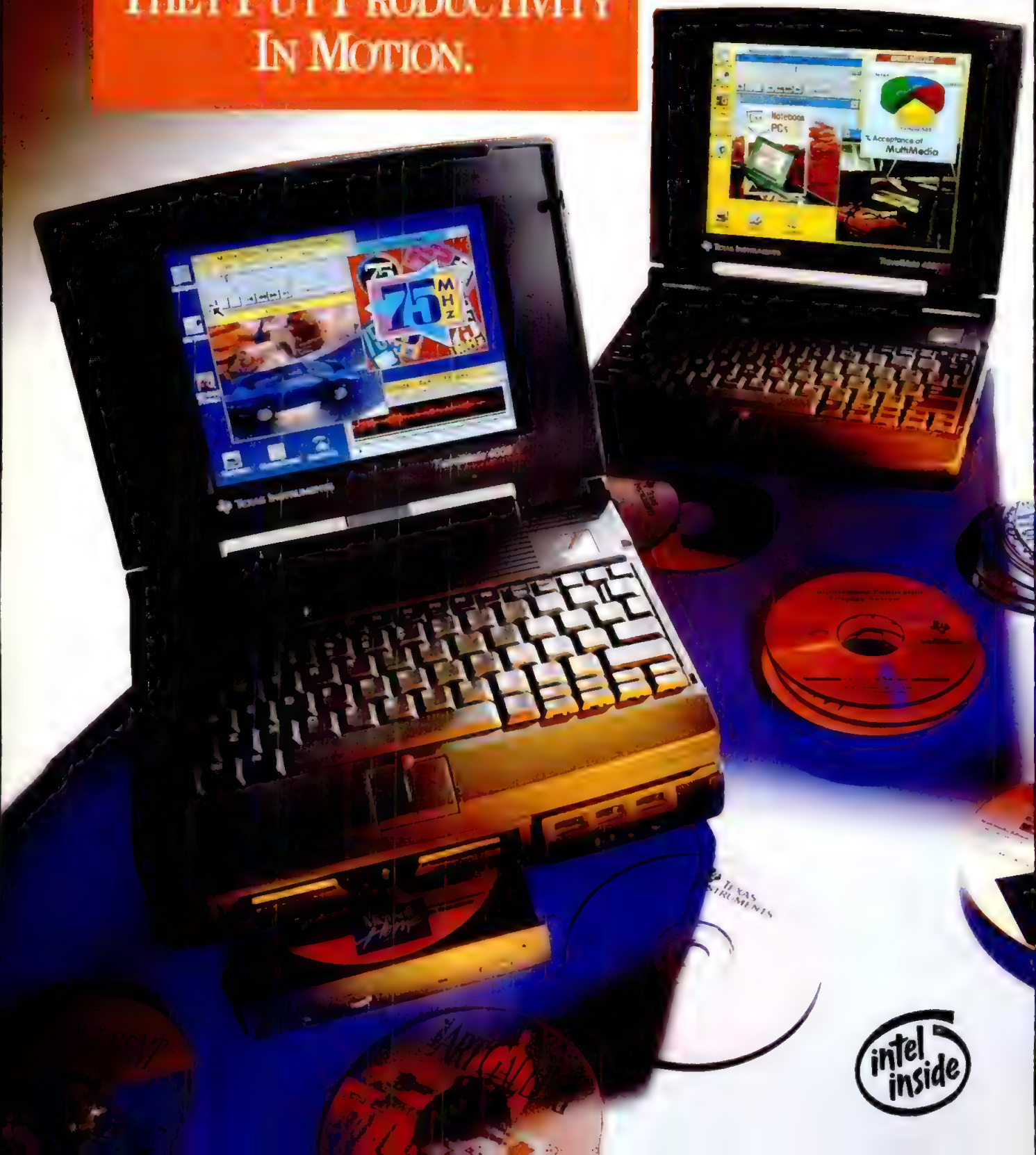
CIRCLE 361 ON READER SERVICE CARD

They Not Only Sound Great, They Put Productivity In Motion.



TravelMate™ 4000M Series

- 486 processors from 50MHz to 75MHz
- Active Matrix Color or Dual Scan Color Displays
- Hard Disk Drives: 200MB to 455MB*
- Built-in 16-bit sound
- PCMCIA Type III Slot
- Integrated Pointing Device
- Multiple Interfaces including SCSI II, Audio Controls, and MIDI/Game port
- Intel Indeo™ Video

Portable CD-ROM Docking System

- Double-speed CD-ROM drive (250ms)
- Built-in stereo speakers
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- SCSI II connection
- Optional SCSI II bay for additional hard drive

The right multimedia notebook can give you a decided advantage in your work. That's why we made the TravelMate M Series notebook computers.

These powerful multimedia machines give you desktop PC capabilities in a portable package, including the industry's first truly portable, battery-powered CD-ROM Docking System. So you have the freedom to use them anytime, anywhere.

The M Series continue the TravelMates' award-winning reputation for incredible power, performance and reliability. Each comes standard with 16-bit sound, a built-in speaker and microphone, plus a choice of 486 processors to handle full-motion video and speed you through other multimedia applications.

And the optional, battery-powered CD-ROM Docking System gives you access to the growing libraries of CD-ROM software, no matter where you are.

The TI TravelMates. They're for people who are going places.

For more information or the name of the dealer nearest you, call *1-800-TI-TEXAS* (1-800-848-3927).

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TEXAS INSTRUMENTS

PC MAGAZINE EDITORS' CHOICE
August 1994
TM4000M/25

SERVICE & RELIABILITY PC MAGAZINE READERS' CHOICE
July 1994

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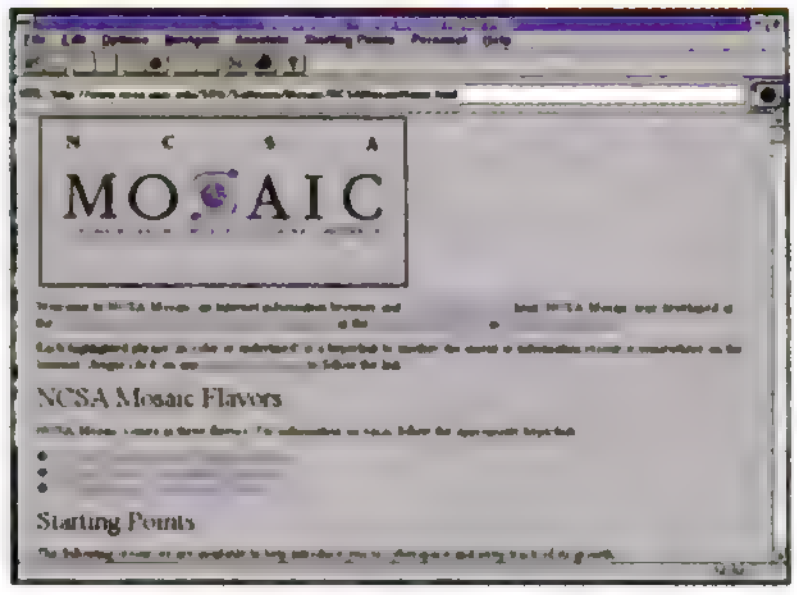
CIRCLE 304 ON READER SERVICE CARD

Communications Software

WINNER

NCSA Mosaic

National Center for Supercomputing Applications



IF 1994 WAS THE YEAR OF THE INTERNET, THE PRODUCT THAT OPENED THE Net up to millions of users was Mosaic, the World-Wide Web browser created by the National Center for Supercomputing Applications.

Mosaic users who flocked to the Web were intrigued by the quality of its information, as well as its graphical format and hypertext links. Mosaic's simple visual environment, hosted in X Window, on the Macintosh, and now in Microsoft Windows, turned Web exploration from an arduous treck to a pleasurable stroll. Suddenly, it seemed as if people everywhere were using Web browsers and associated HTML publishing tools to create their own home pages. No wonder, when following a series of promising-looking hypertext links can easily take you around the world in a matter of minutes.

Mosaic is not just an iterative improvement over the way things used to be done. It reinvents the paradigm, bringing multimedia to users of what has long been a text-based network system. With your desktop computer, you can have access to data distributed around the world—wherever it is stored. Mosaic lets you get there just by clicking your mouse, so you don't need to be bothered with where it is. You don't need to memorize addresses; you just connect. Believe it or not, Mosaic makes the Internet easy to use. Others are building enhanced browsers and many are using Mosaic as a starting point, but it's clear that Mosaic started a revolution.

▶ *National Center for Supercomputing Applications, University of Illinois, 605 E. Springfield, Champaign, IL 61820; 217-244-3473.*

Communications Standards

WINNER

V.34 Communications Protocol

Telecommunications Industry Association, TR-30.1 Modem Subcommittee

WE'VE BEEN WAITING FOR FASTER MODEMS FOR SOME TIME, BUT THE RATIFICATION OF THE V.34 SPECIFICATION THIS year sets the stage for 28,800-bits- per-second throughput to become the next standard for high-speed modems. This specification squeezes just about all the bandwidth you can get out of the existing telephone network.

V.34 is radically different from earlier modem standards. Most notable is its use of a complex probing tone at the start of each connection. This comprehensive test, an integral part of the handshake, explores the characteristics and faults of the phone line. Based on the results, two V.34 modems can use these results to determine the optimal use of the line and achieve the fastest connection. V.34 doesn't leave older hardware off the hook, either. It supports at least 118 different combinations of symbol rate, carrier frequency, and encoding patterns, letting you connect with other modems at a dozen different data rates—from 2,400 bps up to the full 28,800 bps. The V.34 specification also includes the time-tested V.42 error control and V.42bis data compression standards.

Above all, now that the specification is ratified, we have a world-wide 28,800-bps modem standard that actually allows different brands of modems to speak to one another.

▶ *International Telecommunications Union, Place des Nations, CH-1211, Geneva 20, Switzerland; 41-22-730-5111; fax, 41-22-730-5853.*

28.8K OPTIMA Modems From Hayes.

Twice The Maximum Speed And V.34!

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Computer Publication Lab-Tests Prove It! In the past year, OPTIMA 288 has swept the speed and performance awards for fastest modem and it's still capturing awards today. Just think how much money you could have saved with an OPTIMA over other 28.8K modems.

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CIRCLE 136 ON READER SERVICE CARD

Utility Software

WINNER

Stacker, Version 4.0

Jim Riley, Stephen Mickelsen, Clay Mayers, Jim Freeman, Doug Whiting

STACKER HAS LONG BEEN THE MOST ADVANCED OF THE PC DISK-COMPRESSION PRODUCTS, but the SmartPack techniques in Version 4.0 take disk compression to new heights.

Until now, all the major compression products have used something called *cluster packing*, a technique that allows normally unusable space in the last cluster of a file to be dedicated to another file. Version 4.0 goes cluster packing one better with *sector packing*. Since the last sector in a cluster is almost always partially unused, sector packing lets Stacker squeeze even more data onto your drive by dedicating the remaining space in that sector to some other file. If your hard disk has 8K clusters, for example, a 1-byte file uses 8K of disk space without compression. It uses 512 bytes (one sector) of disk space with most compression products but only 1 byte of space with Stacker 4.0. The rest of the space is then available for other files..

The advent of new 32-bit operating systems in the coming year will change the face of disk compression yet again. But with its strong track record for innovation, Stac should be well placed to continue its impressive innovations.

▶ *Stac Electronics, 12636 High Bluff Dr., San Diego, CA 92130-2093; 800-522-7822.*

FINALISTS

Helix Software's Cloaking technology

Michael L. Spilo, Daniel Fabrizio, Jonathan Daub, Francis Refol

THERE HAVE BEEN MANY TECHNOLOGIES DESIGNED TO free up space in conventional DOS memory, but the most advanced and flexible we've seen is offered by Helix Software's Cloaking.

Cloaking makes it possible to load the executable code for TSRs and device drivers into extended memory, where it runs in 32-bit protected mode. This can drastically reduce memory usage below the first megabyte—freeing upper memory (640K to 1MB) as well as conventional memory (below 640K).

The Cloaking Developer's Toolkit lets developers write device drivers and TSRs that can take advantage of Helix's Cloaking technology under most third-party memory managers. Helix's Multimedia Cloaking package also uses Cloaking technology to provide a mouse driver, disk cache, and CD-ROM driver. Other developers are using it to create their own cloaked drivers.

▶ *Helix Software Co., 47-09 30th St., Long Island City, NY 11101; 800-451-0551.*

LapLink for Windows

Russ Barrett, Mike Begeman, Matt Bogusz, Mike Burr, Michael Crawford, Orin Eman, Tom Landon, Todd Paul, Matt Peloquin, Steve Perrin, Charles Pyne, Steve Thatcher, Mark Zehr

TRAVELING SOFTWARE'S LAPLINK HAS ALWAYS BEEN ONE of our favorite utilities, but LapLink for Windows is much more than a simple Windows port of this popular file-transfer tool. Its most impressive new feature is SpeedSync, a technology that identifies and transfers only the changes you've made to a file since the last time you transferred it. If you've changed only a few words in a document or a few records in a database, LapLink can now transfer your file dramatically faster.

The new LapLink for Windows also adds remote-control capability. What's more, Traveling Software has accomplished all of this without losing the essential ease of use that has long made LapLink so popular.

▶ *Traveling Software Inc., 18702 N. Creek Pkwy., Bothell, WA 98011; 800-343-8080.*

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CIRCLE 067 ON READER SERVICE CARD

Graphics Software

WINNER

trueSpace

Roman Ormandy, Bruce Walter, Peter Starke

CALIGARI'S TRUESPACE OFFERS A COMPLETELY NEW TAKE ON THE WORLD OF 3-D modeling and animation by using a Windows-based, icon-driven user interface that will bring 3-D to a much wider set of users. High points include the ability to render only parts of your work, to select a variety of textures and bump maps for rendering, and to create AVI files for multimedia playback. The package also supports output to insert/edit tape decks for creating broadcast-quality animation.

trueSpace's intuitive interface lets you use the mouse cursor to move your wireframe model across the *x*-, *y*-, or *z*-axis in real time. This can be especially useful when you are setting up path-based animation for your model or determining how it interacts with other elements in your 3-D space. You can also set up an unlimited number of views and light sources, giving you enormous flexibility of viewpoint within your 3-D world. Unlike many other renderers, the trueSpace renderer works from within Windows. In the past, 3-D modeling and animation have been highly cumbersome. Caligari's trueSpace changes all that by packing the power you need into a unified, intuitive tool.

▶ *Caligari Corp., 1955 Landings Dr., Mountain View, CA 94043; 800-351-7620; in Canada, 415-390-9600.*

FINALISTS

Kai's Power Tools 2.0 for Windows

Kai Krause, John Wilczak, Larry Coopet, Ben Weiss

KAI'S POWER TOOLS 2.0, A SERIES OF POWERFUL PLUG-IN graphics tools, stands out for the amazing special effects it lets you create. Did you ever want to generate vibrant psychedelic skies, create an illusion of paper corners lifting off a surface, or add a slew of other unique textures, shadings, and fractal patterns? Kai's Power Tools, which works with Adobe PhotoShop, CorelDRAW, or any other graphics package that supports Adobe's plug-in architecture, uses a host of mathematical tricks to let anyone create such effects.

The product's revolutionary user interface presents you with a variety of striking visual metaphors—including spheres, wheels, tabs, dials, and sliders—that control the tools you use to build effects.

Kai's Power Tools has quickly become a must-have package that changes the way designers work. Its beautiful effects set a new standard, and its speed and ease of use let artists concentrate on the ends, not the means.

▶ *HSC Software Corp., 6303 Carpinteria Ave., Carpinteria, CA 93013-2901; 805-566-6200.*

Micrografx Picture Publisher, Version 5.0

Craig Simmons, Ted Rogers, David Custalow, Nezar Gharbia, Cliff Levesque, Brian McGlasson, Joseph Mills, Michael Neal

MICROGRAFX PICTURE PUBLISHER 5.0 BRINGS ELEGANT productivity enhancements to one of the most time-consuming aspects of image editing: trial-and-error experimentation.

As you work, Picture Publisher's Command List keeps track of changes while you apply them to all or parts of your image. The Command List, which is fully editable, can function as a macro, letting you replay some or all of your changes to another copy of the image.

This provides the ultimate Undo capability. If you don't like the way recent changes affect earlier work, you can simply revert to any saved version of your file and reapply all your changes in any order, leaving out the ones you don't like. You can also experiment with a low-resolution proxy version of an image and apply final edits to the high-res original.

▶ *Micrografx Inc., 1303 E. Arapaho Rd., Richardson, TX 75081; 800-733-3729.*

THIS REPORTER KEPT GOING

DELL'S NOTEBOOK KEEPS GOING AND GOING...
Walter S. Mossberg, *Wall Street Journal, 9/8/94, Personal Technology Section*

"...any serious traveler who uses these portable PCs knows what he or she really wants; a battery that gets decent life, one that lets you use your computer continuously on a six-hour transcontinental flight. All the fancy features in the world aren't worth a damn when the battery dies out over Kansas City and your report won't be done till Philadelphia.

AND GOING

Well, listen up you beleaguered notebook nomads: I have found the Holy Grail. It's a full-featured, high-powered, name-brand notebook PC...

AND GOING

In fact, I'm writing these words on a Latitude XP that's been left on for about 10 hours and used now and again during that period to run various programs. The rest of the time, it's been idle, mainly in a low-power state imposed by its automated battery-saving program. It's got about half its charge left, according to the little battery gauge on the screen.

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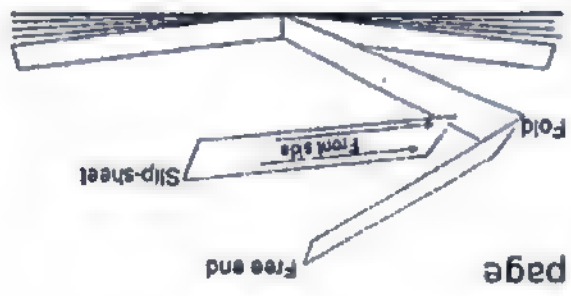

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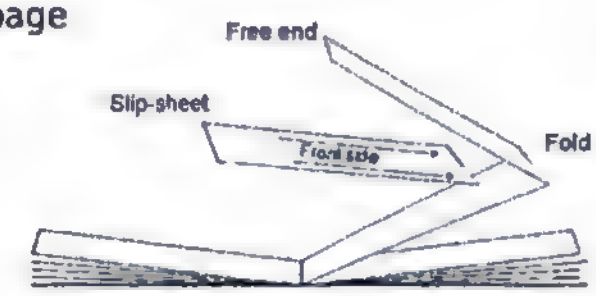

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Back

1. Follow instructions on the other side

1. Follow instructions on the other side

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AND GOING ON

... the Dell Latitude XP, which still has 19% of its power left as I wrap up this column, 15 hours since the battery was charged."

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intel inside

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CIRCLE 158 ON READER SERVICE CARD

Development Tools

WINNER

dBASE 5.0 for Windows

Mike Gardner, Randy Solton, Lloyd Tabb, Bruce Bundy, Ken Smith, Ray Kiuchi, Peter Johnson, Liz Stevenson, Charles Overbeck, Steven Chau, Hin Boen, Kevin Brown, Wayne Davison, Bill Joy

TOOLS DEVELOPERS ARE ALWAYS TALKING UP THE VIRTUES OF object orientation, but dBASE 5.0 for Windows was one of the few products this year to deliver the goods. Its solid object model and productive visual tools are a case study in why we're moving toward objects.

Perhaps its most impressive new feature is two-way visual tools. These let programmers move seamlessly between creating an interface with visual painters and editing a source-code representation of the same interface. Changes to the source code are automatically reflected in the visual object and vice versa. Interface objects incrementally resolve to code as you save your work, and you can look at or edit the code at any time. Borland's release of a visual, fully object-oriented successor to dBASE for DOS marks an impressive turnaround for this classic PC product. It also gives an estimated 6 million dBASE users entry into the world of visual, object-oriented development.

▶ *Borland International Inc., 100 Borland Way, Scotts Valley, CA 95066-3249; 800-682-9299.*

FINALISTS

Microsoft Access, Version 2.0

Dawn Trudeau, Mary Engstrom, David Risher, Ruth Betza, Eric Yamada, Dave Kaplan, Scott Bullock, Bill Bader

THIS YEAR, MICROSOFT ACCESS 2.0 PUSHED THE DESKTOP database envelope in two very different directions. On the one hand, Access's support for engine-based data integrity—including full declarative deferential integrity—makes developing safe, function-rich applications easier than ever. Integrity rules are stored in a true data dictionary and can't be bypassed whether your updates come through an Access application or another tool. On the other, Access's intuitive user interface and host of Wizards set new standards for ease of use, bringing complex relational database work within the grasp of the nonspecialist.

Other vendors are implementing similar feature sets, but Access was the first to show that the most powerful PC database could also be the easiest.

▶ *Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400.*

Oracle7 Server, Version 7.1

Andy Mendelsohn, Roger Choplin, Gary Hallmark

ORACLE7 SERVER, VERSION 7.1, THE LATEST RELEASE OF the ground-breaking Oracle7, brings powerful symmetric multiprocessing features—arguably the hottest trend in SQL development today—to SQL databases.

While many SQL databases currently support multi-CPU SMP hardware, Oracle7 leads the way in its ability to actively parallelize important database operations including queries, loads, and index creating. Under ideal lab conditions, we've seen certain operations run twice as fast when a second CPU and matching I/O resources are added.

Version 7.1's core feature set reads like a compendium of all that's right with today's SQL databases. Its unusual multiversioning concurrency model, where readers do not block writers, continues to provide superb performance in demanding mixed-transaction environments.

While Oracle7 has many top-notch competitors, it continues to define the standard that others strive to match.

▶ *Oracle Corp., 500 Oracle Pkwy., Redwood Shores, CA 94065; 800-672-2531.*

After Hours

WINNER

DOOM

John Carmack, John Romero, David Taylor

WITH ITS MONSTERS AND GORE, ID SOFTWARE'S DOOM ISN'T EXACTLY THE height of political correctness. Yet DOOM is the game that riveted our attention in 1994. The reason we love it isn't just the ghoulish subject matter; more than anything, it's the ingenious technology under the covers that makes this shoot-'em-up so compelling. DOOM's 3-D graphics, texture mapping, and navigation engine are nothing short of phenomenal. In an era where many graphics-intensive games are serenely slow, this one is wickedly fast. As one of our editors put it, your viewpoint spins so quickly that it's enough to induce motion sickness! But there's a lot more to DOOM than just cool graphics. Allowing multiple people to play in the same game was a master stroke on id's part. In addition, DOOM is an extensible game that lets people construct their own worlds. We've seen all sorts of unique DOOM locations—our favorite being the *PC Magazine* offices at One Park Avenue.

▶ *id Software, P.O. Box 1230, Greeley, CO 80632; 800-434-2637.*

FINALISTS

Microsoft Flight Simulator, Version 5.0a

Bruce Artwick, Mark Randel, Steve Setzler (Bruce Artwick Organization, Ltd.); Brad Hinkel, Jon Solon (Microsoft Corp.)

RECOGNIZED AS THE CLASSIC PC FLIGHT SIMULATION, Microsoft Flight Simulator offers a convincing flight model and superb texture-mapped, scalable scenery that's light years ahead of the static (though beautiful) imagery of games like Myst. You can take off and land at the airport of your choice, from the familiar Chicago Midway to Paris's Charles de Gaulle. You can choose the level of airport traffic in the air and on the ground, specify the time of day or night, change the season, and adjust cloud cover or weather conditions. You can pick your plane from among a single-engine Cessna, a Learjet, a Sopwith Camel, or a sailplane.

Version 5.0a significantly improves both the flight model and joystick response. Try circling La Guardia in heavy air traffic in a blizzard at dusk with a crosswind and you'll agree that what Flight Simulator offers is more like real flying than any other product on the market.

▶ *Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400.*

Myst

Rand and Robyn Miller

INNOVATIVE LARGELY FOR ITS INTELLIGENT USE OF AMBIENT sound and its well-defined plot, Myst represents a new approach to entertainment: There's no inventory, no time limit, and players don't die. An adventure game decked out in its finest attire, Myst draws you into its vast world of incredibly rendered images. There you explore the deserted Myst Island, solving puzzles in search of clues that will unravel the mystery of its vanished inhabitants, among whom is the Island's creator—a writer of fantastical books that transport readers into other worlds—and his two sons, one of whom he suspects of destroying his books.

Myst is completely nonlinear: Once you understand what kinds of clues you're looking for, you can wander through the game, enjoying the beautifully rendered images and original music, entering other worlds, and then returning to the island. Myst's graphics and integrated sound have made it both popular and much-imitated.

▶ *Broderbund Software Inc., P.O. Box 6121, Novato, CA 94948-6121; 800-521-6263.*

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*Official 1993 Monitrak U.S. monitor sales research

CIRCLE 329 ON READER SERVICE CARD

People of the Year

Jim Manzi and Ray Ozzie

IT WASN'T TOO LONG AGO THAT PERSONAL COMPUTER software implied one application, designed for one person. Over the past year, that concept has been changed forever, replaced by the recognition that people naturally work together in groups, and that applications need to make interaction far easier.

Behind this transformation lies Lotus Notes, one of the most influential products ever seen in the personal computer business. Since its introduction in 1988, Notes has literally defined groupware for many people. Built on a distributed replicated database and offering a combination of discussion-tracking features, electronic mail, forms capabilities, data storage, and its own programming interface, Notes has grown to become the preeminent platform for developing group applications.

Ray Ozzie and his team at Iris Associates brainstormed the concept of group applications and ran with it, creating a product with the potential to change the way we work. Jim Manzi, chairman and CEO of Lotus Development Corp., understood the potential of the product and went to work transforming Lotus from a spreadsheet company to a communications software company.

MANZI

OZZIE

Ozzie's leadership in the development of Notes and Manzi's farsighted dedication to the Notes movement have fundamentally changed the way we use computers.

Lifetime Achievement

Vinton Cerf and Robert Kahn

THIS MAY BE THE YEAR OF THE INTERNET, BUT THE HARD work of creating it started 25 years ago. In 1969, a team of researchers funded by the Defense Department's Advanced Research Projects Agency (ARPA), started work on linking together computers at a handful of universities and research facilities. This first network was the ARPANET, the direct precursor of today's Internet. The pioneers who built it also created many of the networking standards and protocols in use today.

CERF

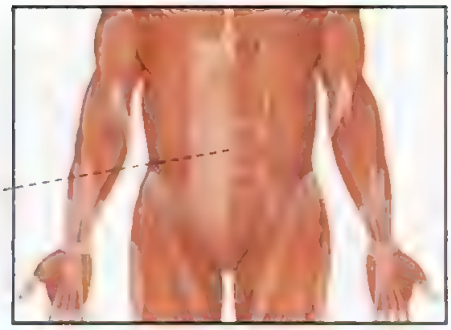
KAHN

Vinton Cerf, recognized as the father of the Internet, ran the Internet Society from its inception until this year. He pushed the Internet toward large-scale use as it branched out into a national research network and later into a general network connecting thousands of computers. He is also one of the principal creators of TCP/IP.

Robert Kahn was a key member of the original ARPANET team and cocreator of TCP/IP. He is credited with initiating the Internet program at ARPA. He is currently president of the nonprofit Corporation for National Research Initiatives and a member of the board of directors of the Internet Society.

Scores of others have made outstanding contributions. J.C.R. Licklider was the first director of ARPA's Information Processing Techniques office, where the idea for the Net originated. Robert Taylor of ARPA initiated the research, and his successor, Lawrence Roberts, is largely credited for pushing the network's development.

Photographs by Seth Resnick (top left); Millicent Harvey (top right); Katherine Lambert (lower left)



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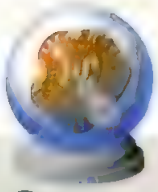


Seymour's PC Predictions

BY JIM SEYMOUR

Sometimes crystal-ball work is surprising: The view is a little muddy up close, but clearer further out. This year it's relatively easy to make some guesses about where we're going to wind up, but it's harder to see just how—and how fast—we'll get there. A year from now, the personal computing landscape won't look very different. Most business PC users will still rely on desktop machines, though a significant minority will have traded power for mobility by moving to notebooks. Pentiums and Pentium clones will define the standard desktop PC, while the home market will still be dominated by desktops. Intel's 75-MHz Pentium chip, designed especially for high-end notebooks, will have claimed the top of the notebook food chain, though most of us will still be using variations on the 486 theme in our portable machines. Multiprocessor machines will no longer be rarities, but they will still live mainly in the wiring closet as servers. PCI will have killed off EISA—and VLB, as well—partly on its own merit, partly on the success of Pentium-class CPUs.

The landscape of three and five years out is easier to see, if still hard to plot on a time line. The number of people moving to notebook PCs will have increased dramatically three years from now—and definitively in five years, by which time conventional desktop machines will be used mainly for special purposes like CAD or DTP. Those notebook PCs of 1997 and 1999 will be much more powerful than today's desktops, finally letting such power-hungry functions as videoconferencing escape that archaic desktop box. By 1999, PCs will be widely recognized as communications tools that also happen to provide the computation power we'll expect as a normal part of business and personal discourse. By serving as our cellular phones, fax machines, and videoconferencing stations, notebooks

The Future of Software Integration

BY MICHAEL J. MILLER

Strategies for making applications work together are almost old as applications themselves. The desire for integration has given us integrated software and huge software suites, but in the future we'll care less about applications and more about the documents we're trying to create. This will change the face of application integration. By the end of the century, we'll be at home with object-oriented documents that belong to no single app. In a seamless environment, you'll build text objects with text-editing tools, math-aware objects with cell editors, and graphics objects with drawing tools. Custom tools designed for your particular industry, organization, or task will be common.

Microsoft's Object Linking and Embedding (OLE) 2.0 specification marks the beginning of this trend, but in three to five years, you'll be able to do a lot more. Objects will be any shape; editing tools won't be constrained by windows; and objects will be freely distributable across a network.

Microsoft continues to refine OLE, but competitors will be an important driving force. OpenDoc, the brainchild of a vendor consortium that includes Apple, IBM, and WordPerfect/Novell, offers a vision of smaller, more intuitive components. Taligent, an Apple, IBM, and Hewlett-Packard joint venture, promises an operating system and application frameworks that let developers build object-oriented applications from prebuilt components. We won't see these ventures bear fruit for another one to three years. But we're moving toward making integration an essential part of the way software works.

OSs Take Control

BY RICK AYRE

Be ready for radical change. By the end of this century, applications will be able to write, install, and debug themselves dynamically at runtime from prebuilt components. They'll also know how to optimize themselves to run faster, take up less memory, and distribute themselves efficiently across a network. In this futuristic world, operating systems will be in control.

Trend 1. Operating systems will be much bigger and do much more. Your OS will anticipate your needs, thwart your false starts, and search available network resources for the data, application components, and processor cycles you need. Further afield, OS agents will work on your behalf in an interconnected world. Of course, even the latest PC

Illustrations by David Kahl (Crystal Ball), Mark Matcho

five years hence will be ubiquitous.

The notion of ubiquitous computing itself will be well established. With very-high-speed networking embedded in the walls of office buildings, you'll be able to carry your notebook with you throughout the day and be connected the whole time. By 1999, ATM backbones and widespread access to ISDN lines (even from hotel rooms catering to business travelers) will make out-of-office computing links nearly as fast and transparent. Printers with walk-up wireless connections will be commonplace in the office; credit card–operated versions will be found in airports and hotels—though thanks to electronic communications we'll be visiting both less often. Of course, by 1999, a big majority of us won't even work out of offices. The notebook communicator will have been critical in this fundamental change to American business life.

OSs are far from this ideal. But as the last 16-bit dinosaurs fade, we're seeing hints of things to come. For example, the gargantuan Microsoft Windows NT 3.5 can eat up to 90MB of disk space, but the programs that it runs—at least those that take advantage of all it has to offer—are getting smaller and smaller.

Trend 2. Operating systems will be much better at knowing what you want done and how to do it. IBM's new OS/2 Warp, Version 3, will let you connect to the Internet just by clicking on an icon and filling out a pop-up form. You won't have to install TCP/IP, locate a service provider, or write scripts. Warp will do these and other tasks for you.

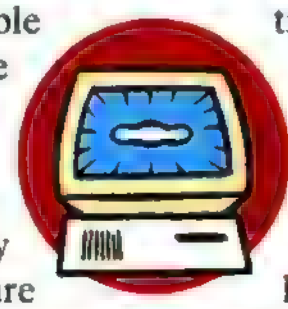
Trend 3. Your operating system will be an active agent, representing you on all the networks with which you interact. One of the most exciting harbingers of the future is the Sony Magic Link Personal Intelligent Communicator running General Magic's Magic Cap operating system. It lets you plug into a telephone line and send your agents out onto the AT&T PersonaLink Services network to work for you. During the same session, other agents can return, having completed their tasks.

Dvorak's Wish List

BY JOHN C. DVORAK

One can understand the basic needs of the computer user by looking at what has happened over the last decade. The most prominent change has been away from the command line to a point-and-click relationship with the computer. Although some heavy-duty hackers think this is a wimpy environment, the trend is clear: ease of use. So in the future, we'll see continuing attempts to make using a computer even easier. The "Star Trek" image of the computer that you chat with about your needs is the obvious and achievable goal. But what is hidden in this equation? What are some of the niceties that will fall out of all this?

Voice capability. I, for one, would like to see a quantum leap in voice-processing capability. It seems to me that you should be able to sample someone's voice with a tape recorder, feed the tape into the computer, and be able to replicate the person's voice precisely. This will come in very handy in the office of the future when you want to take a couple of days off. You sample the CEO's voice and then use it to tell your immediate supervisor that you'll be out for a few days. As far as I'm concerned, this is what PC technology is all about: making life easier.

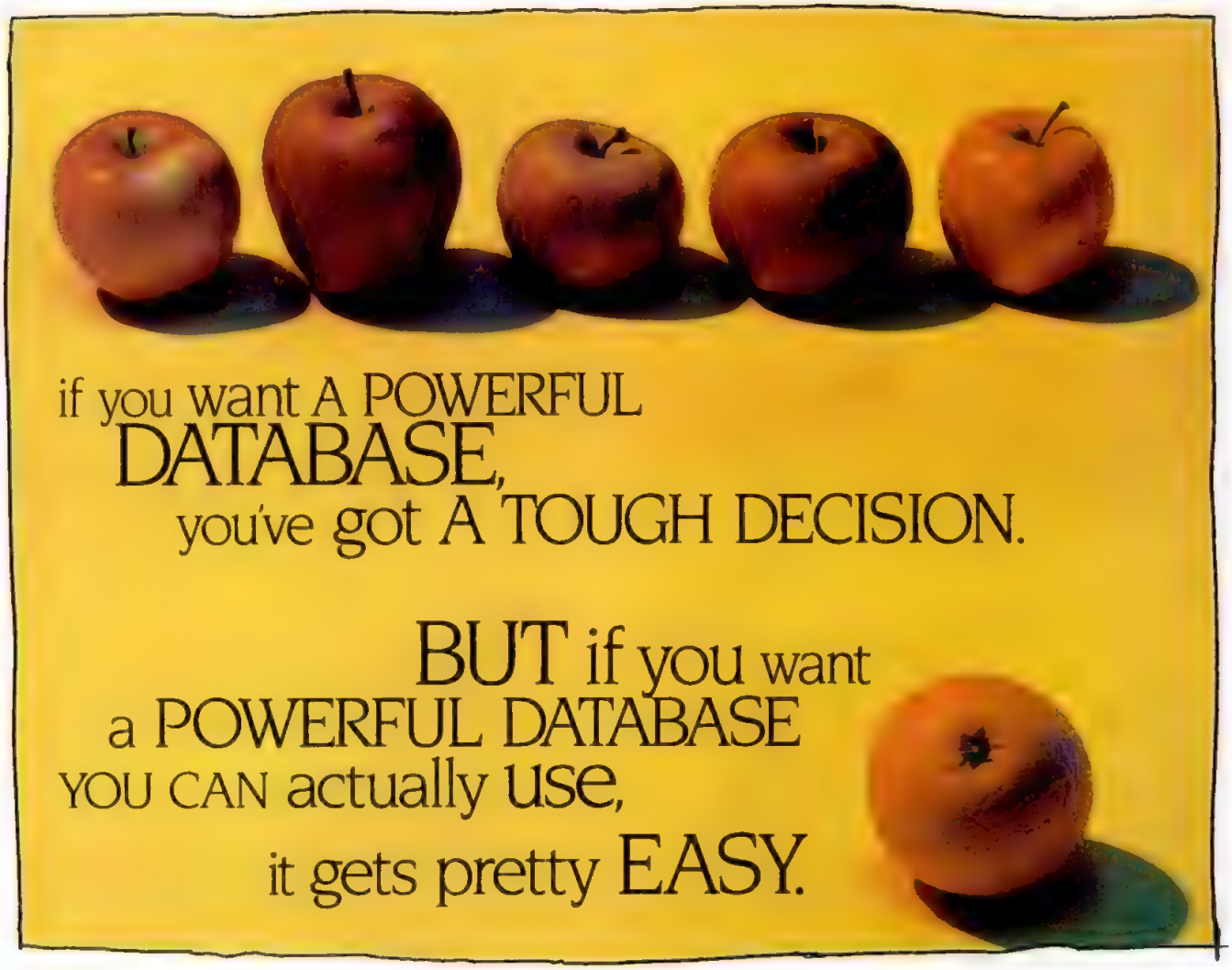


Spycam foils. Most observers feel that computers of the future will be used by bosses to spy on employees. Video cameras on each machine hooked to the corporate LAN will be a network of spycams. Using the same technology, there is no reason why the system itself can't be used to capture a few hours of video showing you working your tail off. When you want to goof off, you call up the captured video and play it back into the system. We need to start thinking in these terms if we are to survive the 21st century.

Direct brain-computer link. Some thought has to be given to a major trend created by computers and ignored by the sages and pundits: Computers take away people's jobs. All those science-fiction stories about robots wanting to kill all carbon-based life forms stem from this fear—that we are essentially useless. But what if computers were eventually hybridized? A direct link from computer to human brain. It sounds kind of creepy, but research trying to link computers to people in new ways is nothing more than the continuation of the trend I mentioned above: ease of use. The heck with voice control. Try thought control.

Cool laptops. Meanwhile, I don't want to waste all this space just talking about an unknown future when we have more immediate needs. How about a laptop that has all the functions of a desktop—including a full-sized keyboard—in some sort of folding, half-pound package? Where are the great engineers when it comes to this sort of thing? Along the lines of portability, I'd also like to see very-high-speed portable computers that let you link into your desktop or corporate network instantly from anywhere in the world at any time. This capability I'd love.

New CD-ROM world. In the next few years we can expect to see CD-ROMs with increased capacity and performance. These improvements will come just in time for a revolution in computing as writeable CD-ROMs become prevalent. Everything we ever do will be archived forever. Scary thought, eh? It means I'll have to face my comments about the brain-computer link for the rest of my life. A small price to pay, I suppose.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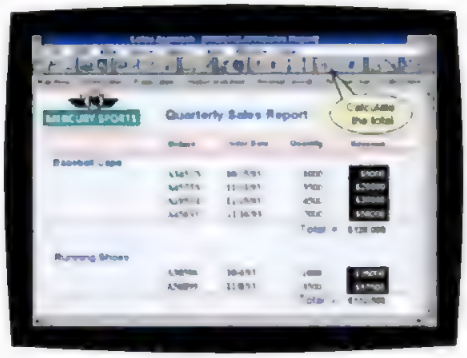

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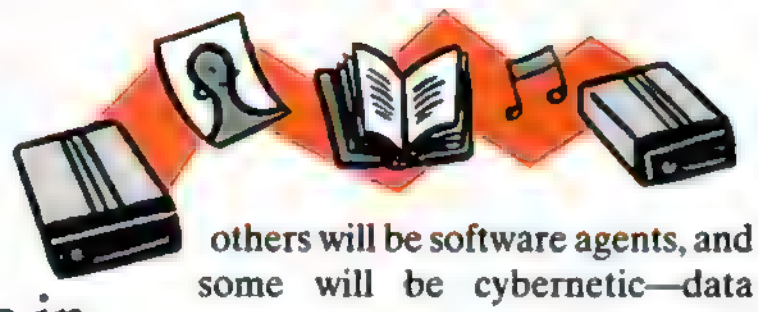
Gazing into Cyberspace



BY BILL MACHRONE & ROBIN RASKIN

Like a huge mass that's been set in motion, the information highway now has a momentum of its own. From now on, its future will be independent of almost everyone, including information providers, government, and business.

As more networks are hooked together, users will expect interoperability. That expectation will rise as the technology matures. Over the next three years, you'll see your information provider becoming much more like the local phone company or cable provider, perhaps adding value but mostly ensuring a fast, reliable path to the world of information. Will the provider be the phone company, cable company, or a weird hybrid? Legislation will make the technical distinction, but the result won't matter to you. By 1996, along with your gas and electric bill, you'll receive an itemized bill for information.

As the Internet continues to grow, its amorphous nature will become more pronounced, which will give rise to new companies and services dedicated to giving it a smooth face. From the chaos, by the end of 1995, you'll begin to see a new breed of worker: librarians and researchers who will help you get to the information you're looking for. Most of them will be human; others will be software agents, and some will be cybernetic—data robots guided by humans. People will specialize in styling and presenting data, just as artists put a face on your published materials. Programs that can read, extract meaning, and create excerpts will become commonplace.

No doubt, the sheer explosion of available information will lead to contradictory findings and illogical conclusions from programs that try to make sense of it all. Humans will be critically important in correctly interpreting the inrush. Software services such as Prodigy and CompuServe will continue to put the appropriate spin and packaging on data for their intended audiences.

Today's on-line world is utterly democratic. All opinions rendered in a newsgroup or on-line forum have the same apparent weight. In the future—let's guess at sometime in the next three years—you'll be able to assign weight based on a knowledge of the opinion-maker's authority; then the on-line world will become more like life. You, or your reader program, will pay more attention to the messages that you find most germane and most authoritative. The role of the sysop will continue to expand from facilitator through moderator to referee.

In the face of all this technology, it will be vital that access be ubiquitous. It's everyone's job to ensure that no one who wants to be part of the infrastructure be denied a voice.

Future Development

BY THOMAS MACE & JAY MUNRO

As 32-bit graphical operating systems and sophisticated object models replace the last 16-bit environments, programmers are gearing up to exploit these rich new resources. While most of today's apps are a hodgepodge of objects and procedural elements, object-oriented programming is clearly the way the market will go.

Over the next year, C++ will gain ground over C, and visual rapid application development (RAD) tools will increasingly adopt true object-oriented paradigms. For the next three to five years, C++ will remain the ultimate high, but fewer of us will need it. Many will switch to visual tools based on object-oriented 4GLs. The increasing abstraction of complex GUI APIs will continue, making transparent cross-platform and distributed-application programming a reality. Frameworks will increasingly incorporate high-level functions. By the end of the decade, we'll be assembling high-level objects without code.

Other forms of prewritten functions will play key roles. OLE objects and 32-bit OLE custom controls will dominate for several years as more and more tools are able to use them. Ultimately, open control and object standards will prevail.

Progress in

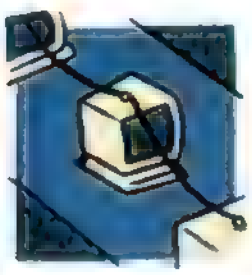
BY BILL HOWARD

We predict clear blue skies for the future of laptop and notebook computers. But giant black rain clouds hang over every other kind of portable computing device, including everything that's ever been heralded as a new paradigm for empowering the mobile work force—personal digital assistants, tablets, handwriting recognition, and wireless communication.

Within the year, a power user's portable will have a high-end Pentium processor, a 1GB 2.5-inch hard disk drive, a 12-inch color display with 1,024-by-768 resolution, a removable back panel to allow overhead projections, a built-in CD-ROM drive, a microphone,

Beyond the LAN

BY FRANK J. DERFLER, JR., & DAVID GREENFIELD



The most important networking trend over the remaining years of the decade will be a switch in market focus from developing the LAN to expanding and reinforcing the WAN. This switch will facilitate and mirror changes in working habits and work environments. Certainly, interesting events such as the deployment of 100-megabit-per-second (Mbps) and faster links to the desktop and the introduction of new client/serverñaware operating systems will take place on local networks, but the real fun will be in the wide area connections.

Looking first at the local environment, we'll bet on one dark-horse trend for 1995: fiber to the desktop. Common wisdom holds that unshielded twisted-pair (UTP) wire can handle data at more than 100 Mbps. But a shortage of high-quality UTP cable and a hard-won appreciation of the difficulty of high-quality installation will force managers to look anew at fiber-optic cable. Its cost is down, and attaching connectors is easier than ever.

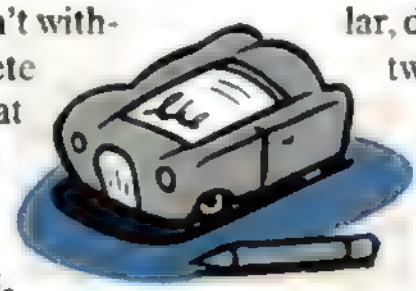
In the WAN service business, we won't even know the names of the major players for several years due to political, legal, and regulatory whirlwinds. The interexchange carriers such as Sprint and MCI are taking a strong early lead by entering the Internet access business and by linking with companies such as Novell and Microsoft. But the resources of cable television vendors and even electrical power companies can't be denied. The local telephone companies are finally offering solid and reasonably tariffed ISDN services, so ISDN use will become common in 1997. By 1999, the Internet as we know it will resubmerge as an academic pursuit while commercial information network spinoffs proliferate.

By 1999, networking will be an invisible part of everything from mobile office work to shopping. Today's important considerations, such as protocols and hardware, will be replaced by a focus on content and affordability.

Portables and PDAs

speakers, and a TV tuner—yet will weigh only 6 pounds.

But in that same year, tablets and PDAs will be shackled by physical constraints: batteries that won't last all day, cases and electronics that can't withstand a fall onto a concrete floor, reflective displays that are too dim indoors or backlit displays that wash out outdoors, less-than-perfect software, and widespread skepticism about the PDA. Users just don't trust pen-based devices that have been pilloried in Doonesbury.



Looking out three and five years, market growth for all portable devices depends most of all on wireless communications that are fast, reliable, and perhaps even affordable. Inside the office, wireless communication can be diffuse infrared running at network speeds; outside, it will run over radio frequencies. Whether that's cellular, digital cellular, a radio modem, two-way paging, or something else depends on whose technology matures soonest—and on the vagaries of government favoritism.

Portable devices may converge at the decade's end into a chameleon computing device: A pocket-size wonder will fit in your coat pocket and double as a cellular phone, location finder, and the slide-in brains of a portable or even desktop computer.

The New CPUs

BY JOHN CLYMAN, JEFF MACE, & NICK STAM

Experience has led us to expect the performance of semiconductors to double roughly every 18 months. This trend will hold true through the end of the century, and its impact on every aspect of computing will be profound.

Over the next year, expect to see continued gradual increases in the peak performance of desktop PCs, along with the first tentative forays into multiple-processor system designs. Three years from now, CPUs will be four times as fast as they are today, and multiprocessor designs will be commonplace. By 1999, improvements in speed will make Pentiums look like today's 386s. At that point, the boundaries between RISC and CISC architectures will have blurred utterly.

CPU performance will be driven by continued shrinkage of the minimum feature size that can be reliably fabricated, an advance that's traditionally spearheaded by high-volume DRAM production. In another year, 64Mb DRAMs will be on the horizon; in three years, they'll be the norm. Five years from today, 256Mb DRAMs will be available, and machines with 64MB of RAM will be typical.

Improvements in semiconductor performance will enable dramatic advances in graphics technology. Over the next year, we'll see the widespread acceptance of higher resolutions and color depths and the beginning of a three-dimensional graphics acceleration on the desktop. Three years from today, support for 24-bit color, full 3-D acceleration, and broadcast-quality digital video will be available on the desktop. In five years, full-motion, near-lifelike virtual-reality capabilities will be commonplace.

HOME PCs

What Goes Into a Great Home PC?

15-inch color monitor
Although many machines ship standard with 14-inch monitors, you'll appreciate the extra real estate that a 15-inch model provides.

Integrated speakers
These are convenient and eliminate messy cabling, although their sound quality often isn't great; it's probably worth the $50 required to buy an upgrade.

Microphone
Although 2001-style speech recognition is still years away, a microphone can give you rudimentary control over your PC's functions and allow you to make voice annotations to documents and add sound to multimedia presentations. Microphones are also great for interactive kids' games.

Joystick
For many action games, it's a must-have, but with most PCs, you'll have to buy it separately.

Software bundle
Quantity doesn't always mean quality; look for a combination of productivity and entertainment titles. Windows and DOS should also be included.

24-hour, 7-day support
Seek out companies that provide support after regular business hours; chances are that's when you'll be setting up or using a home PC.

Keyboard and mouse included

Windows front-end software
If you're unfamiliar with Microsoft Windows, these "front ends" or "shells" can make a PC more approachable for novices. They're an acquired taste.

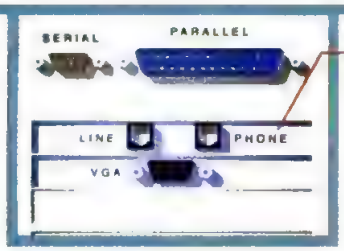
PC Magazine Labs tests 23 multimedia-equipped PCs to find out which of these systems deserve a place in your home.

By Bill Howard

No, OOBE is not a new visual programming environment. It is not a medal awarded by the Queen of England. OOBE stands for *out-of-box experience*, and it is the Holy Grail for vendors of home computers. The vendors want their customers to be satisfied with their new computers from the moment they pull open the flaps on the carton.

And these days, just about everybody wants to be a vendor of home computers. PCs are now affordable enough and powerful enough and (almost) easy enough to use that we finally have a

Illustrations by Jack Harris, Jr. Visual Logic



Labeled back-panel ports
These make it easier to tell what goes where.

16-bit Sound Blaster-compatible sound board
Games and educational software rely heavily on music and sound effects. Look for a wavetable-synthesis board to provide richer, fuller sounds than do basic FM synthesis models.

486DX2/66 or faster CPU
A fast Pentium CPU is the best bet for the home, so that demanding multimedia titles won't make your PC seem outdated in another year. But we found the best-integrated, most user-friendly systems with good software bundles had 486DX2/66 CPUs.

Caddyless double-speed CD-ROM drive
A CD-ROM drive lets you take advantage of the best educational, game, and reference titles—and it makes installation of today's big applications much easier. Caddyless models mean you don't have to buy $5 protective housings for disks, but they also mean you won't be able to use your PC on its side.

Mini-tower case
Case size is a matter of personal preference, but we think the mini-tower strikes the best balance. You may find the ease of an all-in-one case attractive, but it commits you to a 14-inch monitor.

8MB of RAM
All PCs should have this minimum amount of memory to run Windows effectively. Also make sure you get 256K of processor cache.

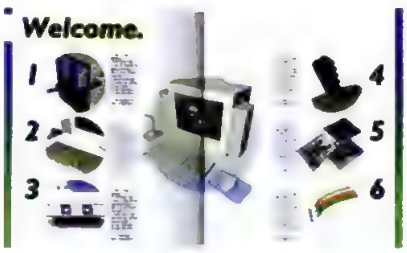
Local-bus graphics
This helps ensure that Windows runs quickly.

Color-coded cables
These make it easy to figure out what gets connected where.

Energy Star compliance
Systems that comply with the EPA's Energy Star standard draw limited power when they're idle, so you can leave them on around the clock.

Internal 14,400-bps fax modem
A fax modem lets you send files electronically and use your PC as a fax machine. Some fax modems support telephony features that let you set up an answering machine with multiple mailboxes. Avoid 2,400-bps models; they're too slow.

Box-topper and quick-start guide
If you've never set up a PC before, the quality of the vendor's documentation can be critical. The best home PCs include step-by-step illustrated instructions to help you through the process.



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robust, fast-growing home computer market after a major false start more than a decade ago with the likes of IBM's PC*jr* and Coleco's Adam.

In this issue we review 23 multimedia computers; our evaluation comprises not just the usual performance testing, but also an examination of how easy the systems are to set up and use, and the quality and quantity of the software bundled with each system.

REVIEW CRITERIA

To be included in this review, products had to be 486- or Pentium-class systems configured for home multimedia use with a double-speed (or faster) CD-ROM drive, a 16-bit sound board, speakers, and bundled software. We set a street-price ceiling of $2,500, which included a system unit with a minimum 8MB of memory and a 340MB or larger hard disk, a color monitor, multimedia components, a mouse and keyboard, and software. Those filters netted us 12 486-based systems, 10 Pentium systems, and one IBM Blue Lightning 25/75. In the end, some of the systems we tested came in with final prices over our $2,500 limit. We disqualified these machines from Editors' Choice consideration but review them nevertheless to provide a fuller picture of the home PC market.

RECENT REVIEWS

▶ **For Love or Money**
December 6, 1994 .....page 110
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▶ **New Life for Your Old PC?**
November 8, 1994.....page 110
15 CPU upgrades.

▶ **File Servers: Data on Demand**
October 11, 1994.....page 187
5 NetWare file servers.

▶ **Pentium Powerhouses**
September 27, 1994.....page 112
40 90-MHz Pentium systems.

There are a few major PC vendors whose systems are not included in this review. ZEOS International, for instance, declined to participate because the company felt that a home system that wouldn't skimp on performance would cost $3,000. Zenith Data Systems did not participate because it doesn't target its computers toward the home market; that's the province of Packard Bell, now a subsidiary of ZDS. Hewlett-Packard Co. eschews the home market entirely, and Digital Equipment Corp.'s home PCs are still on the drawing board. We weren't able to acquire machines from AST Research, Ares Microdevelopment, Austin, or Epson in time for testing.

PERFORMANCE: HOW IMPORTANT?

The typical selling price of a multimedia home PC system currently falls between $1,500 and $2,000. You can spend less money, but we believe you should invest more. At the very least, don't buy anything less than the 50-MHz or 66-MHz version of the Intel 486DX2 processor. You can find a multimedia system with a 33-MHz 486-class processor for as little as $1,250, but you shouldn't buy it. Paying more now will inevitably save you money in the long run, since the multimedia system you buy today won't seem so painfully slow—and in need of replacement—in two years.

Multimedia programs put more of a strain on your computer than business applications do, so it makes sense to have the most powerful PC you can afford to buy. To get first-class performance, you'll spend between $2,000 and $2,500 for the fastest reviewed systems.

Many of the Pentium systems reviewed here are based on Intel's older 60- or 66-MHz chips, but two systems were based on the newer and faster 90-MHz version of the processor. But in spite of our feeling that Pentium PCs are the best bet for the home, the most home-oriented systems in this roundup were actually the 486-based machines.

HOW EASY TO SET UP?

Among the 23 systems we tested, we found the biggest difference was in ease of setting up the hardware and installing the software—in other words, that out-of-box experience. Several years ago, Packard Bell was the first vendor to recognize the perils of not making the hardware easy to set up and configure. Selling to less sophisticated consumers through retail distribution channels

• Compaq Presario CDS 520 Model 420
• Packard Bell 486DX2/66 Multimedia System

If it's ease of use, the comprehensiveness of the out-of-box experience, and an overall sense of fit and finish that set the best home PCs apart, then the winners in this roundup are clear: The $1,957 Compaq Presario CDS 520 Model 420 and the Packard Bell 486DX2/66 Multimedia System (about $2,200 street price). While both PCs were based on 486DX2/66 CPUs and were not performance leaders, we think they are by far the best-rounded systems in the bunch. We were disappointed that none of the high-end Pentium units reviewed could provide the same clear home orientation; but today you just can't buy an under-$2,500 Pentium PC that provides a home-oriented experience and a quality software bundle.

THE WINNERS

You don't have to know a thing about PCs to be comfortable starting with either the Compaq Presario or the Packard Bell 486DX2/66. Packard Bell's illustrated instructions are as clear as setup information gets, and Compaq includes a setup videotape and a series of quick-start guides. Both systems include front ends to make Windows accessible to new users, and both can function as a telephone answering machine. The Packard Bell 486DX2/66 even includes a television board, and its software bundle is very impressive. We feel that its user-friendliness and these extras make up for its poor showing on our Service & Reliability survey.

One caution if you buy either of these PCs retail: Get at least 8MB of RAM. Many stores still sell units like these with 4MB, which isn't sufficient to run Windows effectively. You should also be aware that Packard Bell sells its machines under many different model names.

HONORABLE MENTION

Two other systems each earn an honorable mention: the AcerPower 9812TG and the AT&T Globalyst 360 TPC. The AcerPower's software bundle is strong, its boxtopper detailing system setup is excellent, and its A.C.E. (Acer Computer Explorer) Windows front end is one of the best around. This PC, based on a Pentium/60 CPU, costs $2,598.

The $2,199 AT&T Globalyst has stunning telephony features, including a full-duplex speakerphone and a well-implemented digital answering machine. This 486DX2/66-based PC would suit home offices well.

What We Liked—and Didn't

Today's home computers offer plenty of unique features—some of them terrific, making the PC friendlier and more accessible and others of more dubious value. Here is a brief summary of the things we liked and didn't like about the machines we tested for this review.

Integrated Speakers

Speakers built into the monitor or system unit minimize setup hassles and reduce the number of stray cables, but they often sound muffled or tinny.

Monitor Power Plug

If you can plug the monitor into the back of the system, you can turn the computer on and off with a single button. This feature is especially great for young children.

Unclear Power Button

It's easy to mistake the power button for the CD-ROM's eject button on this system. The fact that neither button is clearly labeled makes this even more of a problem.

Box-Topper

Also called a "welcome mat," this nifty aid gives illustrated, step-by-step directions for setting up your PC. Some systems also come with quick-start guides or even a videotape.

Windows Front-End Software

Some manufacturers provide shells to make Windows easier to use. They may help novices, but experienced users often find them a nuisance.

where a 30-day, money-back, "no questions asked" guarantee was the norm, Packard Bell experienced return rates approaching 20 percent—caused by buyer remorse rather than mechanical defects—which nearly destroyed the company's reputation. In response, Packard Bell developed a box-topper (or "welcome mat"): a giant, illustrated setup guide to what plugs in where; it's the first thing users see when they open their boxes. The company also color-coded the various cables and connectors and created a shell called Navigator, which puts an easier-to-use front end on Windows. The box-topper and Windows shell are now standard on many other companies' systems. Compaq's Presario series goes one better and includes a setup videotape.

Compaq simplifies the setup process by offering a one-piece system unit/monitor combination. This is worth considering if you are happy with a standard 14- or 15-inch display. (If you wish to move up to a 17-inch display, you will need to add from $500 to $800 to the price of a system.)

FREE SOFTWARE BUNDLES

One of the most appealing aspects of a home PC is getting lots of software for free, or almost for free. Vendors pay 10 to 20 cents on the dollar for software in quantity, meaning you can get $1,000 worth of software that adds only $100 or so to the price of your system. Often you'll get a low-end integrated software program such as Microsoft Works, which includes word processing, graphics, spreadsheet, and a database; a personal finance package such as Intuit's Quicken; a CD-ROM–based encyclopedia or atlas;

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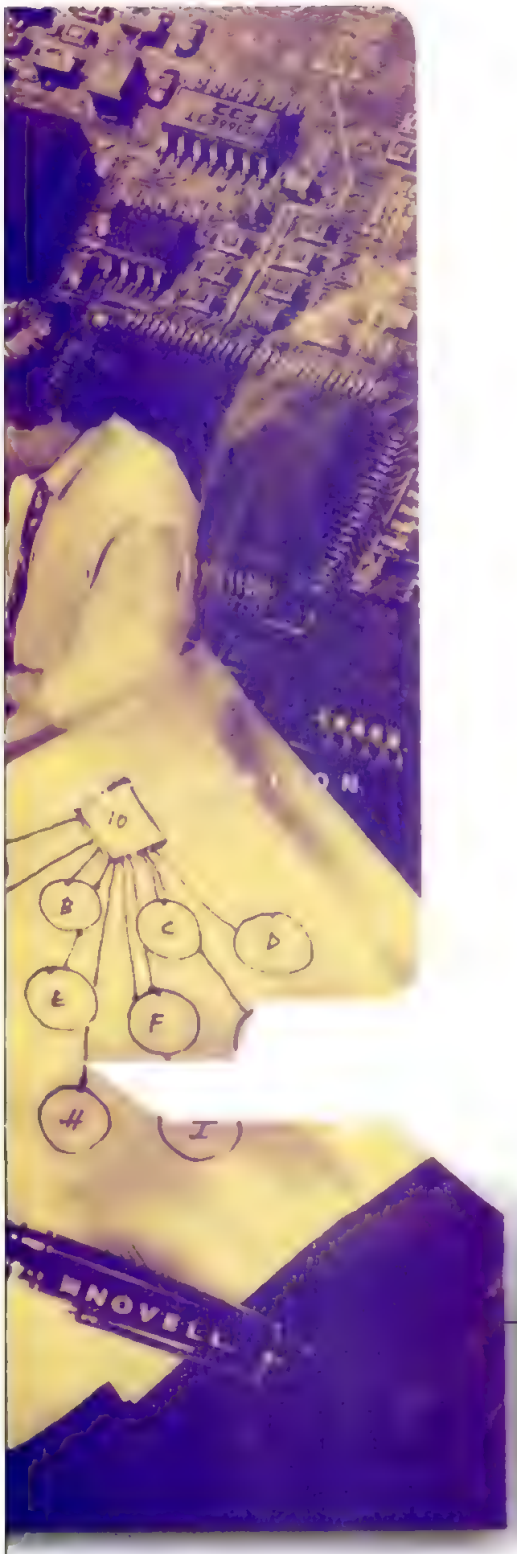
intel inside

MICROSOFT WINDOWS READY TO-RUN

yes It runs with NetWare

All prices include hard disk drive (VL2, N2, M2, Interactive PCs, XM2 210MB IDE, XU 270MB SCSI-2). Prices do not include monitors. Microsoft and the Windows logo are registered trademarks and Windows is a trademark of Microsoft

R D P C s



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some games; and introductory access (one month or 10 hours) to several on-line services such as America Online, CompuServe, or Prodigy. You'll get DOS and Windows too.

If you're comparison-shopping, look at the quality as well as the quantity of software titles. If you get 27 free applications on CD-ROM, how many are ones you'd pay even $10 for if they weren't bundled with the PC? To most people, Microsoft Encarta is worth a lot more than the Encyclopedia of U.S. Endangered Species (an actual title).

Ideally, DOS, Windows, and the applications have all been preinstalled for you. On the other hand, Compaq only does a partial preinstall; you have to sit through 20 minutes of questions and flashing screens until the system is ready to run. Woe unto you if you accidentally specify French as your language and country when you meant U.S. English; there is no easy way to switch back.

The best vendors include a DOS/Windows system CD that gets you back up and running in less than half an hour if your hard disk is corrupted; the worst don't include any CD or floppy system disks and gently urge you to spend an hour backing up your system onto 15 to 20 floppy disks.

Suitability to Task: Home PCs

What most distinguishes a home PC package is its software bundle. Our Suitability to Task ratings take quantity into account, but emphasize quality to a greater extent. The systems we tested tended to be strong in focused areas: none of them received an *excellent* score in all four categories.

In our **Educational/Reference** category, we rate the quality and quantity of such bundled software as encyclopedias and travel guides.

The **Entertainment** category indicates how well suited the system is to playing games. Factors include the quality and quantity of bundled entertainment software and multimedia hardware. We also noted whether the system includes a joystick.

The **Productivity** category indicates how well the PC is suited to business and home productivity tasks, whether you are taking work home, running a business from home, or managing personal affairs. Performance, capacity, and expandability factor into this score, as does the inclusion of software titles such as Microsoft Office, Microsoft Works, and Intuit's Quicken.

The **Setup** category indicates how much setup assistance is provided for new users. Box-toppers, introductory videotapes, quick-start guides, Windows front-ends, labeled ports, and color-coded cables are some of the factors that earn extra points for a product. The availability of after-business-hours technical support is considered as well.

VENDOR SERVICE AND RELIABILITY

In our 1994 Service and Reliability Survey, we sent questionnaires to 17,000 random subscribers; about half replied. Vendors for which we received at least 50 responses are rated *above average, average,* or *below average* in three areas:

Reliability scores indicate to what degree PC owners felt their systems met their overall expectations for consistent operation.

Repair service scores are culled from users who contacted the vendors to have their PCs repaired; the scores reflect their satisfaction with the service they received.

Technical support scores measure how well a vendor's telephone support met the expectations of respondents.

SUITABILITY TO TASK	Company Name
Educational/ Reference	EXCELLENT
Entertainment	GOOD
Productivity	FAIR
Setup	POOR
VENDOR SERVICE & RELIABILITY	
Reliability	ABOVE AVERAGE
Repair service	AVERAGE
Technical support	BELOW AVERAGE

FEATURES THAT MATTER

Every system we reviewed can play multimedia software which typically runs from the CD-ROM drive and uses the sound board to create audio that is played through the speakers. You also can play audio CDs through the system to accompany you while you work. There were more similarities than differences in terms of CD-ROM drive performance; we don't think that a triple-speed drive is worth any more than a double-speed drive for most applications.

Virtually all of these CD-ROM drives are caddyless, meaning you stick the disk in directly, rather than putting it in a protective $5 caddy (these look something like oversize, transparent 3.5-inch floppy disks). Desktop PCs with caddyless drives can't usually be operated on their sides as mini-tower PCs.

You'll find significant quality differences among the sound boards and loudspeakers. If the vendor offers you a $50 upgrade to a better pair of speakers, jump at it. Most of the "courtesy" speakers sold with systems are, to put it bluntly, terrible. You don't have to be an audio snob to notice the tinny sound. Sometimes you may have to trade off quality for convenience—for instance, if the speakers are embedded in the system unit or monitor.

Many of these systems come with fax modems that allow you to log on to on-line services and send and receive faxes. In some cases you can even set up your system so the vendor's technical specialists can log on remotely to look inside your system in order to diagnose and possibly fix your problem. (Of course, if your system won't start up at all then the remote diagnostic capability isn't good for much.)

Some modems go further and add telephony capabilities, which means they can act as answering machines and possibly as telephones. This is great if you're running a small business out of your home, because you can have multiple voice mailboxes, but it can be overkill otherwise. Understand: You're using a $2,000 PC to perform a task handled perfectly well by a $129 telephone/answering machine. (For more information about telephony features provided in these systems, see the sidebar "The Dawn-

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Test your I.Q. (Information Quotient) on DTK 486 FEAT-39 Systems' compatibility.

This is a Matching Test to demonstrate the DTK FEAT-39 Systems' compatibility. Your job is to circle a T (Tower), M (Mini-Tower), or D (Desktop) in the space next to the logo for each system you think is compatible with the software or industry standards represented by the logo.

Your reward is the self-satisfaction that comes from being well-informed and knowing where to source the most compatible systems in the industry. (Answers below.)

1. yes NetWare Tested and Approved — **Novell Compatible***
T M D
(Circle One or More)
*Check with your DTK SalesPro for specific NetWare configurations.

2. Microsoft Windows Compatible — **MS-Windows Compatible**
T M D
(Circle One or More)

3. energy EPA POLLUTION PREVENTER — **Energy Star Compatible**
T M D
(Circle One or More)

4. Solaris COMPATIBLE — **Solaris X86 Compatible**
T M D
(Circle One or More)

5. OS/2 Ready! — **OS/2 Compatible**
T M D
(Circle One or More)

6. Microsoft Windows NT Compatible — **Windows NT* Compatible**
T M D
(Circle One or More)
*Check with your DTK SalesPro for specific Windows NT configurations

7. Intel Inside 486 DX4 75/100 MegaHertz — **Intel 486DX4 75/100 MHz Compatible**
T M D
(Circle One or More)

8. CLASS FCC B — **FCC Class B Compatible**
T M D
(Circle One or More)

9. UL LISTED — **UL Safety Compatible**
T M D
(Circle One or More)

10. VESA Local Bus — **VESA Compatible**
T M D
(Circle One or More)

All FEAT-39 Systems are compatible with Intel 486 SX-25 through DX4-75/100 MHz microprocessors.

All FEAT-39 Systems include 8 expansion slots (3 VLBus slots) and 200w or 250w power supplies.

ANSWERS: 1 TMD 2 TMD 3 TMD 4 TMD 5 TMD 6 TMD 7 TMD 8 TMD 9 TMD 10 TMD. Not surprisingly, all three DTK FEAT-39 systems are compatible with software and/or industry standards shown.

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"FLYING TOASTERS"

I'm in a boardroom the size of a small country surrounded by every guy I've ever competed with since junior high all in the same blue suit, nice tie and shiny shoes listening to a guy with a Napoleon complex tell us the first right proposal gets the business and something like half the property rights to Central America. Great. Countless portables are lined up on the table and everybody's watching Flying toasters and taking notes. I pop in the Motorola Power Series™ modem Diane gave me this morning. By the time this Little Corporal throws his final glare I've sent the specs. As the suits file out, our proposal slides in.

Right on the screen.

I swivel the portable, wait, and interpret his grunt as positive.

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CIRCLE 367 ON READER SERVICE CARD

Flying Toasters Artwork © 1990-93 BERKELEY SYSTEMS, INC., from AFTER DARK® 2.0. Reproduced under license agreement by McCann-Erickson Atlanta. © Copyright 1994 Motorola Inc.

ing of Desktop Telephony.")

An EPA Energy Star–compliant PC goes into a low-power idle mode when it's not being used. The oft-stated and perhaps overblown benefits of Energy Star compliance include knocking a few dollars a year off your electric bill, keeping your house cooler in summer, and being able to receive unattended voice mail and faxes at any hour of the day. The understated benefits are that your PC is never more than five seconds from being usable if you want to jot down a note, and doesn't make any beep-beep boot-up sounds that wake the household if you want to get some work done in the middle of the night. All 486-based PCs can be Energy Star–compliant, while it's extremely difficult to make the power-guzzling Pentium/60 or Pentium/66 system meet the spec. For power users, that means you need to look at systems based on the relatively scarce DX4/100 CPU, which matches the Pentium/60 and Pentium/66 on performance, step up to the Pentium/90, or wait for the Pentium/75 early in 1995. If you do wait, you'll find the Pentium/75 is the ideal CPU for home multimedia systems.

A handful of systems offer TV tuners that receive signals from broadcast or cable TV, or from a video camera trained on the kids playing in the back yard. The picture appears in a window in the corner of your PC. That's handy if your home office is space-constrained or if you then pipe the video into a multimedia presentation. Otherwise, it's cheaper and more esthetically effective to buy a separate 19-inch TV.

Then there are features that will give you more performance. First and foremost, you need a minimum of 8MB of system RAM. Many systems sold through retail have only 4MB of RAM. Our recommendation: Don't leave the store

Apple: *The Quintessential Home PC?*

By Jodi L. Wynblatt

In early 1984, Apple Computer revolutionized the home PC market with its one-piece, mouse-controlled Macintosh 128K. The Macintosh family—which, according to PC market researcher LINK Resources Corp. has held a steady 15 to 20 percent share of the home PC market since the mid-1980s—has grown and diversified, and is as user-friendly as ever. In contrast, the number of Intel-compatible systems found in homes has almost doubled since the late 1980s to 67 percent today. However, when it comes to ease of setup and use, PC vendors can learn a lot from Apple.

The Macintosh Performa 630 series system that we looked at took only five minutes to set up. Icons appear on every cable and port, so putting the system together is simply a matter of matching these icons. To eliminate any confusion, Apple includes a setup poster and a Getting Started manual (labeled "Read This First") with step-by-step assembly instructions.

All bundled software and system software comes loaded on Performas, so once you put the system together, that's all there is to it—just start it up and go. The power button is located conveniently on the keyboard, and though this location may sound dangerous, accidentally pressing the power button while using the system won't destroy your work. The Performa automatically prompts you to save your work before it shuts down. The keyboard also includes a mouse port, providing easy access and a longer leash for your mouse, as well as a cable guide to help control cable clutter.

The Performa series renews Apple's traditional home-computing leadership.

Performa 630 series systems come with a 2,400-/9,600-bps modem, a 14- or 15-inch monitor with built-in speakers, a 250MB or 350MB hard disk, and 4MB to 8MB of RAM standard. You can also get a CD-ROM drive, the Apple Video System, or the Apple TV System. The standard configurations of these systems sell for $1,500 to $2,350.

If you are not satisfied with your Performa's configuration, upgrading is a snap. The cable-free motherboard pulls out of the system like a drawer after you remove a plastic plate and two screws. This lets you add expansion cards or memory without wrestling with the system or cables.

Besides the standard Macintosh desktop, Performas come with At Ease, a simplified desktop that you can customize for each system user. This feature is great for parents who don't want their children playing certain games or getting into personal files. At Ease also includes a text-to-speech feature, which speaks the name of each button as you pass the pointer over it.

Performa 630 series systems come with 13 or 14 software packages (depending on which model you buy) ranging from productivity software to educational and entertainment titles. Systems with a CD-ROM drive come with several CD-ROM titles as well.

Although Performas are sold through retail stores, office product superstores, and consumer electronics stores, Apple provides service and support directly through its technical support line (open Monday to Friday, 9:00 to 9:00 eastern time) and through its one-year, on-site warranty. You can get additional help through Club Performa, an America Online forum, and by attending Apple user group meetings. □

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without 8MB, and think seriously about 16MB of RAM if you want to have several applications running simultaneously. (Two of the machines in this review came with 16MB of RAM, and the performance benefit of the added memory was dramatic.)

Second-level processor cache, or L2 cache, acts as a high-speed buffer between slower system RAM and the higher-speed CPU. Get 256K for best performance; a few vendors—including Dell in this review—do not provide any L2 cache, which means their systems get left in the dust. A big hard disk of 400MB to 520MB gives you room to expand; 340MB may prove limiting, especially if your system came with a comprehensive software bundle. Our tests have shown the less expensive Enhanced IDE (E-IDE) drive interface actually outperforms the more costly (but more versatile) SCSI.

You'll need 1MB of video memory on your graphics adapter to display colorful images and 2MB to display true-color images.

If you want a custom-configured system, you'll find direct (mail order) vendors are much more amenable to the mixing and matching of components than are most retail outlets and superstores.

Most systems have upgradable CPU sockets if you want to install a faster CPU later, although only a minority of users—less than 10 percent—ever do actually upgrade their processor. You should also think about if and when you'll make the upgrade next year to Windows 95; Microsoft says you'll only need 4MB of RAM, but you'll be safer if you have 8MB.

SERVICE & RELIABILITY

Most PC vendors let you call them directly if you have a question; few require you to call a local dealer for help. In recognition of the needs of home users, the best vendors provide technical support seven days a week, and many offer around-the-clock, or 24-hour, 7-day technical support. Some offer on-site service and others offer it for an additional fee. What is a fair price? The actual cost to the vendor is less than $50 a year; if a vendor charges more, either you are getting great service or the vendor has created another profit center.

Accompanying reviews of major vendors' products, you'll find *PC Magazine*'s Service & Reliability ratings from our most recent survey, in July of 1994. *PC Magazine* readers rated vendors on satisfaction with reliability, repair experience, and technical support. For each of the criteria, they are scored above average, average, or below average. The sum of the scores is ranked A through E. Those receiving scores of above average (A scores) in all three areas receive *PC Magazine*'s Readers' Choice award.

Another part of each review is our Suitability to Task rating, where we judge each system for power, ease of setup (or OOBE), quality of bundled education/reference software, and bundled business software as well as quality of entertainment equipment and software. Our Service & Reliability and Suitability to Task ratings help you zero in quickly on which systems are best suited to your needs.

Vendors will slightly modify their product names, configurations, and software bundles to allow competing retailers to trumpet lowest-price guarantees.

SAME PRODUCT, MANY NAMES

Don't be surprised if you cannot buy a computer with exactly the same model number or name as the one we tested. Vendors will slightly modify their names, configurations, and software bundles to allow competing retailers to trumpet lowest-price guarantees without fear of contradiction, since each technically has a unique product. Vendors may also put different monikers on models with software appealing to home businesses (high-end integrated software such as Microsoft Office), families with young children (learn-to-read games) or teenagers (Scholastic Aptitude Test preparation). These fraternal twins will perform at about the same level, however.

Look in the pages that follow to find out how well various vendors meet the demands of home use.

Acer America Corp.

• AcerPower 9812TG

The $2,589 Pentium/60-based AcerPower 9812TG is designed from the ground up for home users. It puts everything you need to know about system setup right at your fingertips. The PCI/ISA-based machine includes telephony features like a digital an-

swering machine with multiple mailboxes, and its software bundle is strong.

The AcerPower's performance was competitive: It got an above average score on our Winstone 95 tests and an average score on our Graphics WinMark 95 tests.

Inside the unit's box is a poster that details, with photographs, the setup procedure; ports are labeled. There is also a pamphlet with the answers to the ten most frequently asked questions, extended service information, and support numbers.

On bootup, the system software helps you configure a printer, if you have one. Then you're taken into the Acer Computer Explorer (A.C.E.), a Windows front end that details system information and communications, software, and game options. Bundled software ranged from educational packages like Math Blaster to games like Microsoft Golf. On top of trial memberships in America Online and Prodigy, Acer includes an Internet access package called NetCruiser.

—William P. Flanagan

SUITABILITY TO TASK AcerPower 9812TG	
Educational/Reference	POOR
Entertainment	FAIR
Productivity	GOOD
Setup	GOOD
VENDOR SERVICE & RELIABILITY	
Reliability	AVERAGE
Repair service	AVERAGE
Technical support	AVERAGE

▶ Acer America Corp., *San Jose, CA; 800-368-2237, 408-432-6200; fax, 408-922-2959.*

Circle 451 on reader service card

LEGENDARY PERFORMANCE

MICRON
SILICON TO SYSTEMS

Micron systems are engineered to provide the highest performance to your most demanding applications. Without sacrificing system reliability. And through relationships with Intel, Novell, and Microsoft—along with our own reputation as a leading American manufacturer of high-quality semi-conductors—Micron delivers tightly integrated system solutions and the widest range of system configurations available anywhere.

intel inside pentium PROCESSOR

MICROSOFT. WINDOWS NT. READY-TO-RUN

yes NetWare Tested and Approved

OPTIONAL 4-YEAR "PROTECTION PLUS" WARRANTY

Protect your new Micron system for the long haul with one of the most respected and far-reaching names in the service business—General Electric. Purchase an optional 4-year GE Service Protection Plus warranty and you'll get on-site service, parts and labor on the entire system, including the monitor!

GE

POWERFUL

*Optional full sized tower pictured in addition to desktop.

MICRON
SILICON TO SYSTEMS

PC WORLD May 1994 POWERSTATION
PC MAGAZINE January 26, 1993 MAGNUM
PC WORLD June 1994 MAGNUM
PC MAGAZINE April 26, 1994 MAGNUM
PC WORLD October 1994 POWERSTATION
PC MAGAZINE June 28, 1994 POWERSTATION
PC WORLD October 1994 MAGNUM

SOLUTIONS

P90PCI

PC World called Micron's P90PCI PowerStation "a screamer." It outscored all the competition in PC Magazine's Winstone 94, Disk Winmark and Disk benchmark tests. With 90MHz of Pentium™ processor performance and the lowest prices

POWERSTATION

- Intel™ 90MHz Pentium™ processor
- 256K write-back cache, Flash BIOS
- 2X CD-ROM drive, 3.5" floppy
- PCI 64-bit graphics accelerator (2MB)
- "Tool-free" desktop or mini-tower
- Microsoft® Mouse, 101-key keyboard
- MS-DOS® & Windows® for Workgroups

A • 8MB RAM, 527MB IDE hard drive
• 15" Micron 15FGx, 1280NI, .28mm
• Microsoft Works Multimedia CD
$2,299 (Lease $79/month)

B • 16MB RAM, 730MB IDE hard drive
• 15" Micron 15FGx, 1280NI, .28mm
• Microsoft Office Professional 4.3 CD
$2,899 (Lease $99/month)

C • 32MB RAM, 1GB IDE hard drive
• 17" Micron 17FGx, 1280NI, .28mm
• Microsoft Office Professional 4.3 CD
$3,899 (Lease $126/month)

POWERSTATION PLUS

- Intel 90MHz Pentium processor
- 256K write-back cache, Flash BIOS
- PCI 32-bit Fast SCSI-2 controller
- 4X SCSI-2 CD-ROM drive, 3.5" floppy
- PCI 64-bit graphics accelerator (2MB)
- "Tool-free" desktop or mini-tower
- Microsoft Mouse, 101-key keyboard
- MS-DOS & Windows for Workgroups
- Microsoft Office Professional 4.3 CD

A • 16MB RAM, 1GB SCSI-2 hard drive
• 15" Micron 15FGx, 1280NI, .28mm
$3,499 (Lease $113/month)

B • 32MB RAM, 2GB SCSI-2 hard drive
• 15" Micron 15FGx, 1280NI, .28mm
$4,799 (Lease $155/month)

C • 64MB RAM, 4GB SCSI-2 hard drive
• 17" Micron 17FGx, 1280NI, .26mm
$6,999 (Lease $221/month)

D • 128MB RAM, 9GB SCSI-2 hard drive*
• 21" NEC 6FGp, 1280NI, .26mm
$13,699 Lease $426/month)

* Not available in desktop

POPULAR CHOICES

"Once in a while a company really hits all the hot buttons for PC buyers," said PC Magazine. The Micron family of 486 systems is no exception, offering superb performance and highly reliable systems starting at under $1,200. Complete. See for yourself why PC World said "... the 466VL came with everything we've come to expect in a high-performance machine."

466PCI MAGNUM

- Intel 486DX2 66MHz processor
- Pentium Technology Ready (ZIF)
- 256K write-back cache, Flash BIOS
- 4 ISA, 2 PCI, 1 ISA/PCI slots
- 2X CD-ROM drive, 3.5" floppy drive
- "Tool Free" desktop or mini-tower
- Microsoft Mouse, 101-key keyboard
- MS-DOS & Windows for Workgroups

466VL
SAME

A • 8MB RAM
• 420MB 14ms IDE hard drive (PCI)
• PCI graphics accelerator (1MB)
• 14" Micron 14FG, 1024NI, .28mm
• Microsoft Works Multimedia CD

$1,699
(Lease $61/month)

With DX4 100MHz Processor
$1,999
(Lease $72/month)

With Pentium 60MHz Processor
$1,999
(Lease ($72/month)

With Pentium 66MHz Processor
$2,099
(Lease $76/month)

B • 16MB RAM
• 730MB 12ms IDE
• PCI graphics accele
• 15" Micron 15FGx
• Microsoft Office Pr

$2,399
(Lease $87/month)

$2,699
(Lease $97/month)

$2,699
(Lease $97/month)

$2,799
(Lease $101/month)

It's Your Call!
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Buy a Micron Home MPC system and get everything you'll ever need to create a multimedia experience right in your own home. Included is the SoundBlaster 16 sound card, speakers, joystick, CD-ROM drive and fax/modem, plus a wide variety of home productivity and entertainment software on CD.

Every Micron Home MPC comes free with Microsoft *Encarta* CD, Microsoft *Works Multimedia* CD and *Quicken Deluxe Edition* CD. You also get the latest CD games from LucasArts: *Rebel Assault, Day of the Tentacle, and Indiana Jones and the Fate of Atlantis.* Along with trial subscriptions for CompuServe, America OnLine and Prodigy. All included in the one low affordable system price.

P90 Home MPC

- Intel Pentium 90MHz processor
- 8MB RAM, 256K write-back cache
- 527MB 12ms IDE hard drive (PCI)
- 2X CD-ROM drive, 3.5" floppy drive
- SoundBlaster 16 sound card, speakers & joystick
- 14.4/9600 Fax/Modem & WinFax Lite
- PCI 64-bit graphics accelerator (2MB)
- 14" Micron 14FG, 1024NI, .28mm
- "Tool-Free" desktop or mini-tower
- Microsoft Mouse, 101-key keyboard
- MS-DOS & Windows for Workgroups
- Microsoft Works Multimedia CD, Microsoft Encarta CD, Quicken Deluxe Edition CD
- Trial subscriptions for Compuserve, America OnLine & Prodigy
- LucasArts CD games: Rebel Assault, Day of the Tentacle, Indiana Jones and the Fate of Atlantis

$2,499

486 Home MPC

- 2X CD-ROM drive, 3.5" floppy drive
- SoundBlaster 16 sound card, speakers & joystick
- 9600/2400 Fax/Modem & WinFax Lite
- Local bus graphics (1MB)
- 14" Micron 14FG, 1024NI, .28mm
- Low profile chassis
- Microsoft Mouse, 101-key keyboard
- MS-DOS & Windows for Workgroups
- Microsoft Works Multimedia CD, Microsoft Encarta CD, Quicken Deluxe Edition CD
- Trial subscriptions for Compuserve, America OnLine & Prodigy
- LucasArts CD games: Rebel Assault, Day of the Tentacle, Indiana Jones and the Fate of Atlantis

A • Intel 486SX 33MHz processor
- 4MB RAM (expandable to 48MB)
- 210MB 14ms IDE hard drive

$1,399

B • Intel 486DX2 66MHz processor
- 8MB RAM, 128K cache
- 420MB 14ms IDE hard drive

$1,799

Multimedia Upgrade Kit*

- SoundBlaster 16 sound card & speakers • Joystick • Microsoft Encarta CD • Quicken Deluxe Edition CD
- LucasArts CD Games: Rebel Assault, Day of the Tentacle, Indiana Jones and the Fate of Atlantis

$199

*With system purchase only.

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ACMA Computers Inc.

• ACMA P60 MPC

The $2,499 Pentium/60-based ACMA P60 MPC system is well suited for home use, although it's not as polished as some other PCs in this roundup. The system has a software bundle that includes educational, entertainment, and reference titles, but the

machine is more like a standard desktop unit with a few home amenities tacked on.

The system comes in clearly labeled boxes and includes an inventory checklist. The system manual has a short guide for getting started and clearly labeled ports aid system setup. Software bundled with the PC includes International Business and Economic Atlas, Lifestyle CD-Pak (consisting of individual CDs on cooking, gardening, and wine tasting, as well as a reference guide to U.S. National Parks), Mayo Clinic Family Health Book, and Microsoft Bookshelf. On the lighter side, ACMA includes the 1994 Sports Illustrated Almanac and Where in the World is Carmen Sandiego? The system also comes with a microphone and a 14.4-kilobit-per-second fax modem.

The unit's Winstone 95 and $CPUmark_{16}$ scores were above average. Its Disk WinMark 95 and Graphics WinMark 95 scores were also above average. On our DOS-based benchmark tests, the ACMA MPC posted above-average DOS Disk and DOSMark scores and an average DOS Video score. —*WPF*

SUITABILITY TO TASK	
ACMA P60 MPC	
Educational/ Reference	EXCELLENT
Entertainment	EXCELLENT
Productivity	GOOD
Setup	POOR

▶ ACMA Computers Inc., *Fremont, CA; 800-786-6888, 510-623-1212; fax, 510-623-0818.*

Circle 452 on reader service card

Advanced Logic Research Inc.

• ALR Multimedia Express M466D

Although the slimline case of this well-built, 486DX2/66 ISA-based PC doesn't offer much room for expansion—one free slot and no free drive bays in our test unit—the $2,344 ALR Multimedia Ex-

press M466D fits neatly into the home-user market.

ALR's quick-setup guide and labeled I/O ports make the system easy to set up. The case offers tool-free access via thumbscrews, but we found them too small to grip and ended up using pliers.

The unit's Winstone 95 score was above average, while its Graphics WinMark 95 and Disk WinMark 95 scores were average. On the DOS Video tests it was above average, on the DOS Disk tests it was average, and its DOSMark score was below average.

The PC's motherboard integrates the I/O ports, hard disk and floppy disk controllers, and Cirrus Logic video chip set. The unit lacked a ZIF socket and memory expansion is limited to 36MB (probably satisfactory for the home market).

SUITABILITY TO TASK	
ALR Multimedia Express M466D	
Educational/ Reference	POOR
Entertainment	FAIR
Productivity	FAIR
Setup	POOR
VENDOR SERVICE & RELIABILITY	
Reliability	AVERAGE
Repair service	AVERAGE
Technical support	AVERAGE

Such Microsoft software titles as Encarta, Works, Musical Instruments, Dinosaurs, and Golf are bundled with the system.—*WPF*

▶ Advanced Logic Research Inc., *Irvine, CA; 800-444-4257, 714-581-6770; fax, 714-581-9240.*

Circle 453 on reader service card

AT&T Global Information Solutions

• AT&T Globalyst 360 TPC

While the $2,199 486DX2/66-based AT&T Globalyst 360 TPC offers unique telephony features matched by only a few other reviewed PCs, its performance was poor.

A small box labeled "Open First" contains system manuals, software, accessories,

and a quick-setup guide. Our only setup problem was with the combination sound board and modem: The board installed was not the same one pictured in the guide.

On our benchmark tests, the unit's performance was adversely affected by a lack of L2 cache. The unit posted below-average scores on every test except DOS Video, where its score was average.

The system can be used as a fax and digital answering machine; you can also access on-line diagnostic help. The built-in speakerphone has full-duplex capability, and, in addition to the answering machine function, the system offers auto-dialing, multiple mailboxes, and caller ID (where available). The AT&T Globalyst also comes with children's entertainment packages and reference CD-ROMs. (At left, we include NCR ratings because NCR is now a part of AT&T.)—*WPF*

SUITABILITY TO TASK	
AT&T Globalyst 360 TPC	
Educational/ Reference	EXCELLENT
Entertainment	POOR
Productivity	GOOD
Setup	GOOD
VENDOR SERVICE & RELIABILITY (AT&T)	
Reliability	BELOW AVERAGE
Repair service	BELOW AVERAGE
Technical support	BELOW AVERAGE
VENDOR SERVICE & RELIABILITY (NCR)	
Reliability	AVERAGE
Repair service	AVERAGE
Technical support	AVERAGE

▶ AT&T Global Information Solutions, *Dayton, OH; 800-637-2600, 513-445-5000.*

Circle 454 on reader service card

Conceptual design by Robert P. Humeniuk and Jerry D. Flynn of McDonnell Douglas Space Systems

intel inside pentium processor

MICROSOFT® WINDOWS NT™ READY-TO-RUN

BEST OF BYTE COMPEX Spring '94 Winner Best System

American Megatrends

Out-of-this-world graphics have *landed* on the *Intel* platform.

Personal workstations from Intergraph Computer Systems transport you to a world where high-end graphics software runs alongside your office automation tools – at a cost that won't send your budget into orbit. Until now, the processing power required for high-level CAD/CAM/CAE software forced you to work in two separate worlds: a PC for your office tasks and a workstation for intensive graphics design.

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CIRCLE 048 ON READER SERVICE CARD

Benchmark Tests: Home PCs

The home PCs we tested use processors from an AMD 486DX2/66 to a Pentium/90, L2 cache from none to 512K, and both 32-bit and 64-bit graphics accelerator chips. But there's no simple formula for maximizing speed.

What the Numbers Mean

WINSTONE 95

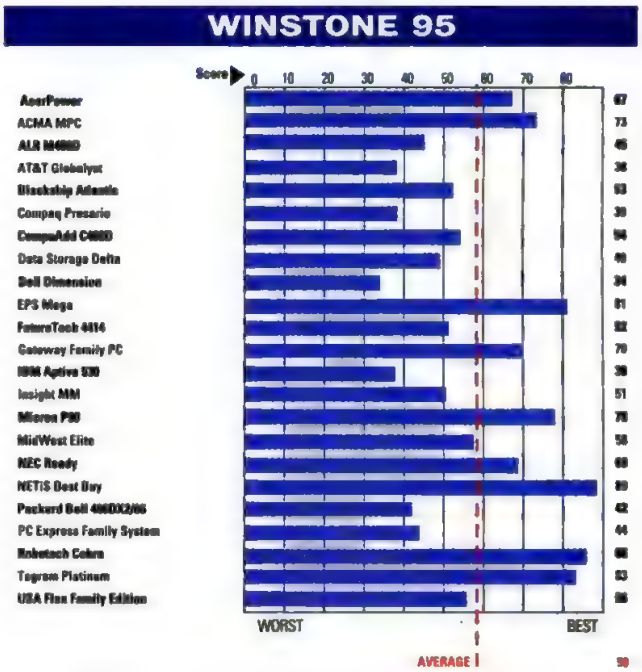
Winstone 95 scores demonstrated some advantage for systems with 16MB of RAM installed. These systems—the EPS Mega Multi-Media and the Robotech Cobra RS Home Runner p60—outscored other machines with equivalent CPUs and faster disk and graphics subsystems but only 8MB of RAM.

The highest scorer on the Winstone tests was the NETiS Pentium N566 Best Buy, a Pentium/60-based system with 8MB of RAM, an ATI Mach 64–based graphics card, and Microsoft Windows for Workgroups (WfWG). Second was the Robotech Cobra, a Pentium/60-based machine, whose strong performance is primarily attributable to its 16MB of RAM.

GRAPHICS WINMARK 95 AND DISK WINMARK 95

We observed two key trends on the Graphics WinMark 95 tests. Units with 64-bit graphics accelerators beat out systems with 32-bit accelerators; and the faster the CPU, the better the results. The Micron P90 Home MPC, powered by a Diamond Stealth 64 card, took top honors. The other Pentium/90 unit, the MidWest Micro Elite Home PC P5-90, finished second. The two Pentium/90s finished first and second, the one Pentium/66 (the NETiS Best Buy) finished third, and the top Pentium/60 units followed. Of the top five Graphics WinMark scores, all were posted by systems equipped with 64-bit accelerators.

On our Disk WinMark 95 tests, WfWG was what powered the winners. WfWG uses a 32-bit disk cache instead of DOS's 16-bit SmartDrive cache; units with WfWG installed took the top places on the Disk WinMark tests in their respective CPU



Blackship Computer Systems Inc.

• Blackship Atlantis

The $1,795 Blackship Atlantis, from Blackship Computer Systems, is a 486DX2/66-based system that uses a combination ISA/VL-Bus architecture. It's an inexpensive PC, and certainly fast for a DX2/66-based computer, but the system doesn't have much to qualify it as a true home or home-office PC aside from some relatively low-value entertainment software.

The Blackship system's packaging and documentations offered little to aid novice computer users. Setup was not especially difficult but could have been made easier. The unit's I/O ports were labeled, but Blackship did not include any quick-setup guide, box-topper, or Windows front-end software.

Blackship states that the Atlantis is

marketed to the home office, but the software included with this VL-Bus system implies otherwise. Titles like San Diego Zoo's The Animals, ChessMaster 2000, and Lord of the Rings were among the 26 programs included, while productivity packages like Microsoft Office (or even Microsoft Works) were conspicuously absent.

The Blackship machine doesn't include the convenient telephony capabilities of the AT&T Globalyst 360 TPC or the Compaq Presario, and it doesn't offer the easy setup of a system like the Packard Bell 486DX2/66.

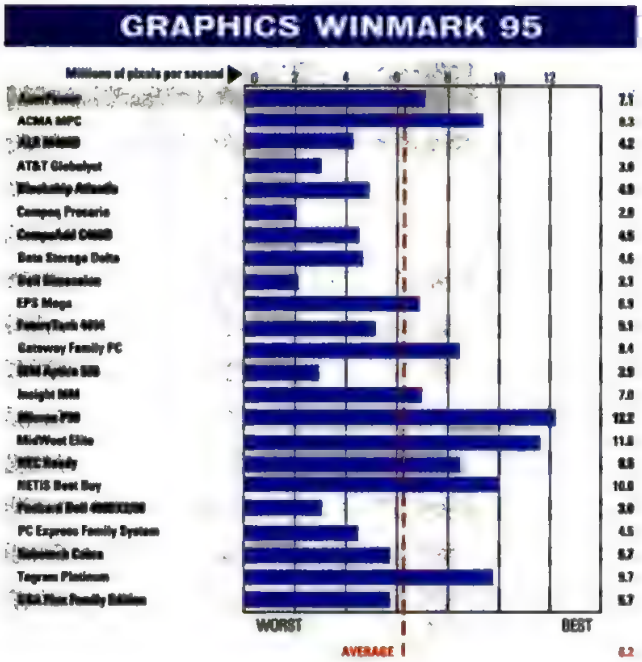
On a more positive note, the Blackship Atlantis held its own in most of our tests when compared with other reviewed DX2/66 machines. Overall, the unit's DOS-based benchmark test performance was consistently average. The system's Winstone 95 score was also average, but its Graphics WinMark 95 and Disk WinMark 95 scores were below average.—*WPF*

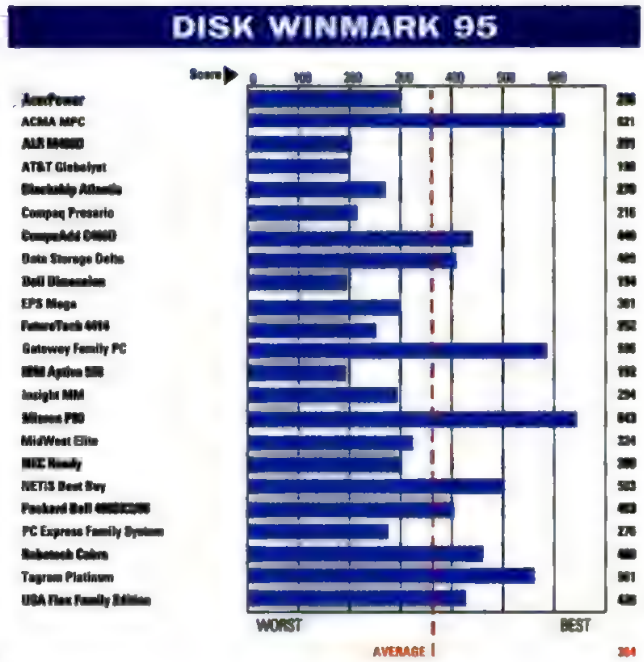
▶ Blackship Computer Systems Inc., *San Jose, CA; 800-531-7447, 408-432-7500; fax, 408-432-1443.*

Circle 455 on reader service card

SUITABILITY TO TASK	Blackship Atlantis
Educational/Reference	FAIR
Entertainment	EXCELLENT
Productivity	FAIR
Setup	POOR

CONTINUES





classes. The Micron P90, equipped with a Conner CFA540A Enhanced IDE hard disk, and the ACMA P60 MPC—powered by the same disk—took first and second places respectively. While the use of 32-bit disk cache in WfWG definitely improves hard disk performance, having the proper Enhanced IDE driver in Windows also helps. We found that the Insight PCI P60 MM, which had the worst Disk WinMark score in the Pentium/60 group, was not using an Enhanced IDE driver in Windows and so could not take advantage of its Enhanced IDE hard disk.

CPUMARK$_{16}$

Among the many CPUs in this roundup, we found the Pentium/90s were two to five times as fast as the 486DX2/66s. The tested systems also had varying amounts of L2 cache, from none to 512K. We expect to find units with more L2 cache performing better than ones with less; that was not the case here. Only the Robotech Cobra came with 512K of L2 cache, which should have given this unit the top CPUmark$_{16}$ score among Pentium/60s; instead, it finished last. We found the culprit was the unit's Forex chip set, which appeared to be

CompuAdd Computer Corp.

• CompuAdd C466D

The $2,362 CompuAdd C466D is a desktop system well suited for PC-literate home users. The unlabeled ports on the rear of the unit and the absence of a setup guide other than the system's manuals make setup fairly difficult for first-time users. This 486DX2/66-based system is, however, stocked with quality components and bundled with a number of good CD-ROM software packages, and it offers some room for expansion through its VL-Bus expansion slots.

The unit's performance was uneven: Disk WinMark 95 and DOS Video scores were above average, Winstone 95 and DOS Disk results were average, and Graphics WinMark 95 and DOSMark scores were below average.

Software bundled with the CompuAdd 466D is extensive and appropriate both for home office and for entertainment and educational use. Titles include Microsoft Works and Money and some good reference software such as Microsoft Bookshelf and Encarta. There is also a Try and Buy CD, from SoftBank, that offers users a chance to audition a wide range of software and offers an opportunity to purchase them.

The CompuAdd C466D comes with a 14.4-kilobit-per-second fax modem and supports sophisticated telephony features such as fax forwarding, paging, and an answering machine function which puts it in a league with the systems we reviewed from AT&T and Compaq. Unlike the AT&T and Compaq systems, however, the C466D cannot be used as just a telephone.—*WPF*

SUITABILITY TO TASK	CompuAdd C466D
Educational/Reference	GOOD
Entertainment	FAIR
Productivity	GOOD
Setup	POOR
VENDOR SERVICE & RELIABILITY	
Reliability	AVERAGE
Repair service	AVERAGE
Technical support	AVERAGE

▶ CompuAdd Computer Corp., *Austin, TX; 800-627-1913, 512-250-1489; fax, 512-250-2070.*

Circle 457 on reader service card

* In Canada, call 1-800-387-3867, Ext. 8673. You may also obtain information through the Internet at URL location: http://www.hp.com/DMO/PERIPHERALS/peripherals_main.html

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Now, with Hewlett-Packard's latest innovation, you can take the next step. The new Color LaserJet printer. It keeps pace with the workload by delivering up to 2 sharp, colorful pages every minute. Or 10 black & white pages. Now, multiple copies of reports and proposals can easily be done in color. Merged text and graphics documents are laser sharp. On plain paper. And printed permanently.

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As you'd expect, this move up to laser color comes with HP's renowned commitment to service and support. For more information or a sample from the fast new Color LaserJet, call 1-800-821-8440, Ext. 8573.*

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HP LaserJet Printers

HEWLETT PACKARD

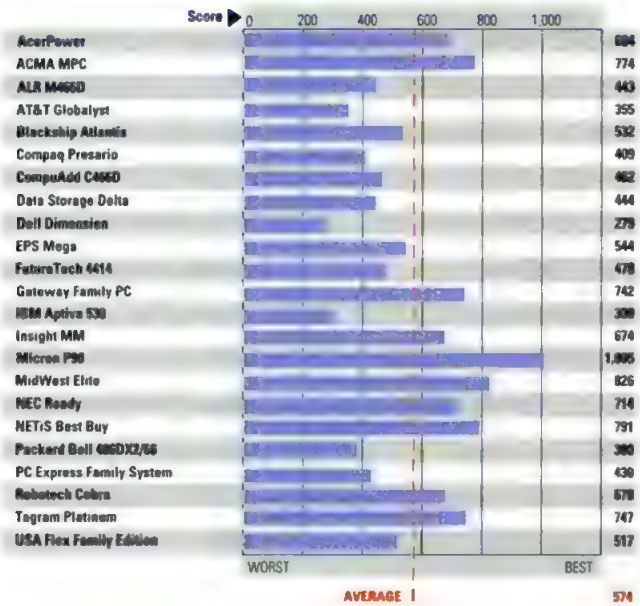
introducing wait states for L2 cache read and write accesses. These extra cycles negated the advantage of the 512K cache.

PC BENCH 9.0

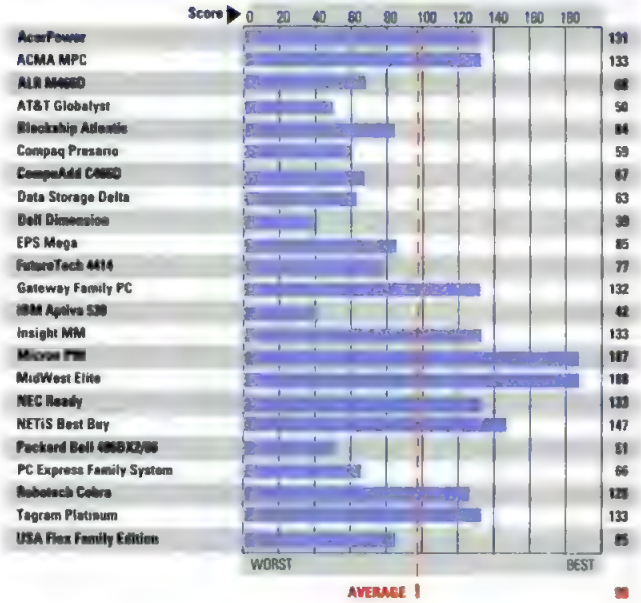
On our DOSMark tests, the systems with the most powerful processors clearly posted the highest scores. The two Pentium/90 units from Micron and MidWest Micro took top DOSMark honors.

What made for a great Windows performance did not necessarily translate into top DOS performance. While 64-bit graphics chips rule in the Windows domain, 32-bit graphics chips are the powerhouses in the DOS realm. Our top DOS Video performer was the 486DX2/66-based CompuAdd C466D. Its Western Digital WD33v334 Rocket graphics chip propelled it to first place even above units with more powerful CPUs. The Packard Bell 486DX2/66 Multimedia System came in second place, with a Cirrus Logic CL-GD5428-80QC-A integrated graphics accelerator.

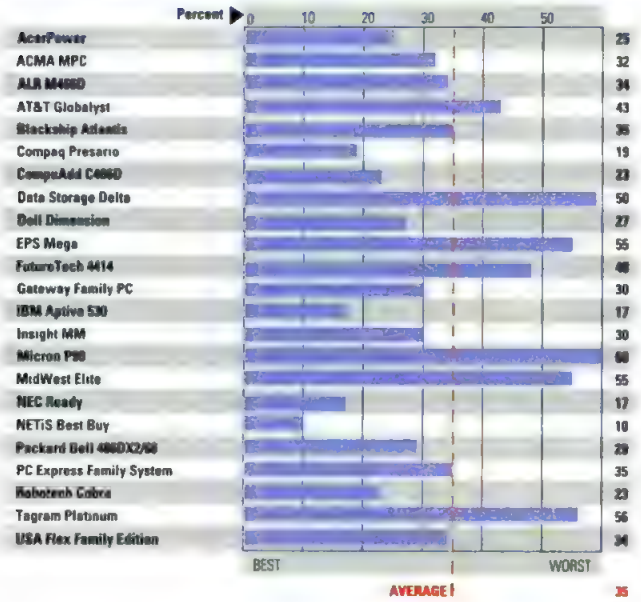
DOSMARK



CPUMARK16



CD-ROM CPU UTILIZATION



CD-ROM DATABASE SEARCH

Without the help of WfWG's 32-bit disk cache, DOS disk performance boils down to processor power and raw disk speed. Among our winners were the Micron P90 (with an Enhanced IDE hard disk) and the NETiS Best Buy (with a Western Digital WDAC 2420 hard disk). The NETiS unit was assisted by its 2MB Bus Logic caching hard disk controller.

CD-ROM TESTS

Differences in the results of our CD-ROM Database Search test show no clear patterns, except that improper item placement in a system's CONFIG.SYS file can affect the CD-ROM subsystem performance. If SmartDrive is loaded before the CD-ROM statement, it cannot cache CD-ROM accesses, thus reducing performance.

Higher scores represent better performance.

	DOS Video (score)	DOS Disk (score)	Winstone 95 Database Category (score)	Winstone 95 Spreadsheet Category (score)	Winstone 95 Business Graphics/ Desktop Publishing Category (score)	Winstone 95 Word Processing Category (score)	CD-ROM Maximum Throughput (kilobytes per second)
AcerPower	2,784	510	5.9	7		-	149
ACMA MPC	4,735	573	6.1	7.7	8.0	7.6	150
ALR M466D	4,203	343	3.7	4.7	5.0	4.8	149
AT&T Globalyst	4,243	306	3.1	4.0	4.3	3.9	149
Blackship Atlantis	4,754	403	4.3	5.4	5.8	5.6	150
Compaq Presario	4,093	344	3.1	3.9	4.3	4.1	149
CompuAdd C466D	5,927	373	4.5	5.5	6.1	5.8	149
Data Storage Delta	4,671	379	4.2	5.0	5.4	5.1	140
Dell Dimension	4,023	238	2.9	3.5	3.9	3.5	150
EPS Mega	4,437	422	7.2	8.3	8.7	8.3	148
FutureTech 4414	4,288	352	4.3	5.2	5.9	5.4	135
Gateway Family PC	3,990	545	6.0	7.3	7.8	7.1	147
IBM Aptiva 530	3,495	281	3.1	3.9	4.2	4.0	150
Insight MM	4,247	430	4.2	5.2	5.4	5.4	150
Micron P90	4,850	727	6.5	8.2	8.7	8.0	140
MidWest Elite	4,174	495	4.8	6.1	6.1	6.1	139
NEC Ready	4,003	493	5.7	7.0	7.6	7.3	150
NETiS Best Buy	2,977	632	7.3	9.2	9.6	9.4	N/A
Packard Bell 486DX2/66	5,019	346	3.5	4.3	4.8	4.3	150
PC Express Family System	4,062	336	3.6	4.5	4.7	4.8	151
Robotech Cobra	3,929	465	7.5	9.0	9.2	8.7	150
Tagram Platinum	4,495	533	7.1	8.6	8.9	8.7	140
USA Flex Family Edition	4,754	370	5.2	5.9	5.8	5.5	149
AVERAGE	4,268	429	4.9	6.1	6.4	6.1	147

N/A–Not applicable. The product did not complete this test

How We Tested

For all tests, we enabled the latest version of SMARTDRV.EXE provided on the tested system; we also used a cache size of 2MB (on 8MB systems) or 4MB (on 16MB systems), with write-behind caching enabled. For systems running Microsoft Windows for Workgroups, we set up a file cache of 2MB (on 8MB systems) or 4MB (on 16MB systems). We directed Windows to use a 20MB permanent swap file but did not change the vendor's setting for 32-bit disk access.

We used the custom graphics drivers for provided graphics adapters and set resolution to 800 by 600 with 256 colors and small fonts. Each monitor's vertical refresh rate was set to 72 Hz. Power management features were disabled, and unnecessary drivers (such as sound card drivers) were temporarily removed.

We used our new **Winstone 95,** Version 1.0, benchmark test suite to measure the machines' performance when running typical Windows applications. Winstone 95 measures the time a PC takes to execute a set of application scripts that exercise 13 of the best-selling Windows 3.1 applications. Winstone weights the individual script execution times using the unit market shares of the applications and normalizes scores against a reference machine—a 386DX/25 Compaq Deskpro/M with 4MB of RAM—whose score is defined to be 10. Winstone also produces system performance scores in four categories: word processing, spreadsheet, database, and business graphics/desktop publishing.

Another test suite, WinBench 95, uses 102 different tests of Windows GDI (Graphics Device Interface) functions to produce the **Graphics WinMark 95**—a measure of PC graphics performance under Windows 3.1. These graphics tests, which are based on extensive application profiling, run in 13 graphics test mixes that WinBench weights and combines to produce the Graphics WinMark. Scores are reported in millions of pixels per second.

WinBench 95 also produces a **Disk WinMark 95** score, which reflects the performance of a PC's disk subsystem under Windows 3.1. The test suite uses a variety of files and directories in a blend based on profiling of applications' disk usage in Winstone.

PC Bench 9.0 predicts processor, video, and disk performance under DOS applications. A composite PC Bench score, the **DOSMark,** is a summary of those three results that approximates overall system performance under DOS.

PC Bench's **CPUmark$_{16}$** score gauges the speed of a PC's processor subsystem, which includes the CPU, secondary cache, and system RAM. PC Bench bases this score on a large (400K) instruction mix and either the floating-point coprocessor test or the floating-point emulation test, depending on whether the tested PC contains a math coprocessor.

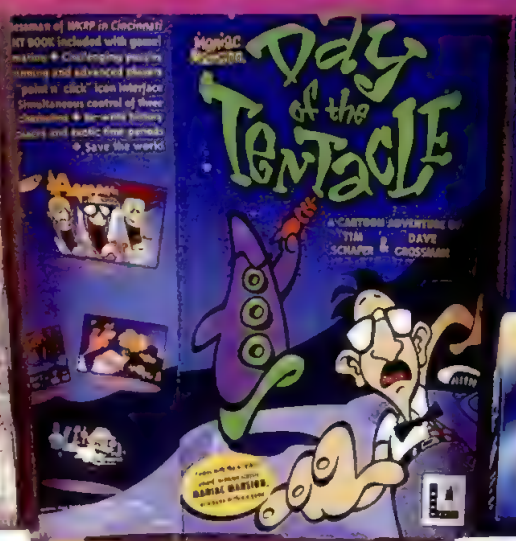
The PC Bench **DOS Video** score indicates the speed of 8- and 16-bit VGA read and write operations involving both text and graphics.

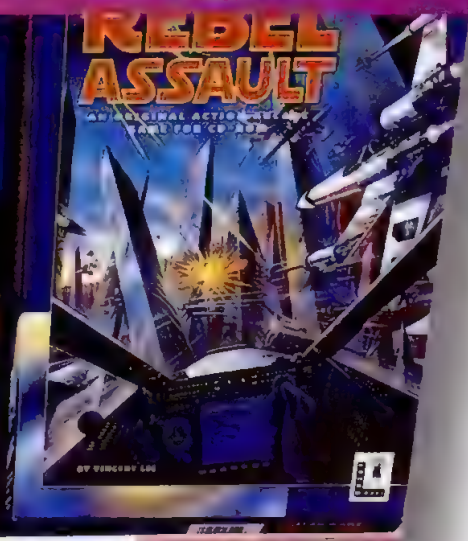
The PC Bench **DOS Disk** score gauges the DOS performance of a PC's disk subsystem, which includes the hard disk, disk controller, and any hardware or software disk caches. The Disk Mix test that produces this score works with hundreds of files in over 100 directories totaling over 28MB in size. The test performs file reads, writes, creations, and deletions in a mix based on the disk usage of a set of profiled applications.

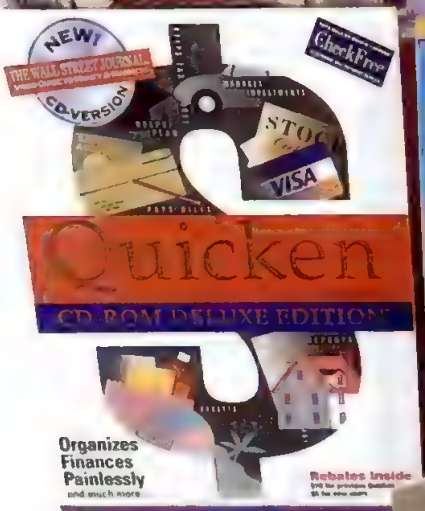
For gauging the quality of multimedia playback, Microsoft Corp. granted us permission to use VidTest—a Windows-based, digital-video performance-test program that has become the de facto standard for measuring performance of multimedia PCs. We use VidTest's Data Streaming test to determine **CD-ROM Maximum Throughput,** a measure of the drive's best-case data-transfer rate in kilobytes per second. The Data Streaming test also measures **CD-ROM CPU Utilization,** which indicates the percentage of the processor's bandwidth occupied by servicing the CD-ROM subsystem at 150 KBps. (For this test, lower numbers indicate better results.)

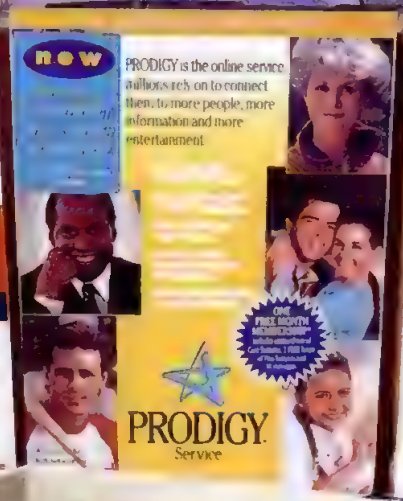
We also tested performance of the CD-ROM subsystems accessing the August 1994 DOS version of Ziff-Davis's Computer Select CD-ROM database, which contains thousands of full-text articles from hundreds of computer-industry periodicals. Searching Computer Select primarily involves sequential-read operations, as large word indexes are scanned. The **CD-ROM Database Search** numbers indicate the time required for the machine to find all 51,460 articles containing a match for the Boolean expression "*the* AND (*is a*) OR *at*". For this test, lower numbers (shorter times) indicate better results.

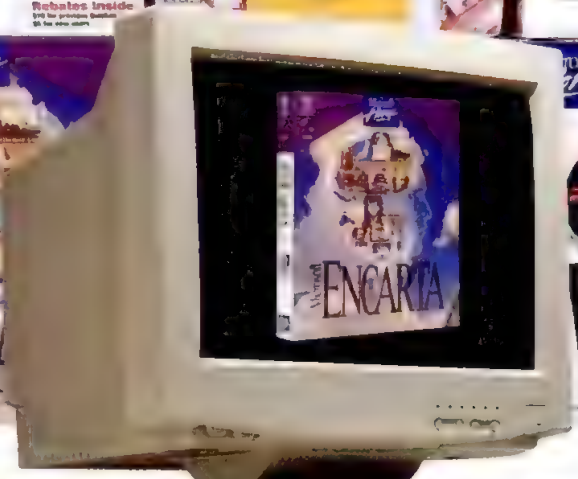
MEET OUR NEWEST











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- 14" Micron 14FG, 1024NI, .28mm
- Low profile desktop case
- Microsoft® Mouse, 101-key keyboard
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- Pentium technology ready (ZIF)
- 8MB RAM, 128K cache
- 420MB 14ms IDE hard drive
- 2X CD-ROM drive, 3.5" floppy drive
- 16-bit stereo sound card, joystick & speakers
- 9600/2400 Fax/ Modem & WinFax Lite
- Local bus graphics (1MB)
- 14" Micron 14FG, 1024NI, .28mm
- Low profile desktop case
- Microsoft Mouse, 101-key keyboard
- MS-DOS & Windows for Workgroups
- MS Works® Multimedia CD*
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- On-line trial services: Compuserve, Prodigy and America On-Line
- 3 LucasArts CD games: Rebel Assault Indiana Jones & Day of the Tentacle

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- Intel Pentium 90MHz processor
- 8MB RAM, 256K write-back cache
- 527MB 12ms IDE hard drive (PCI)
- 2X CD-ROM drive, 3.5" floppy drive
- 16-bit stereo sound card, joystick & speakers
- 14.4 Fax/ Modem & WinFax Lite
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- Microsoft Mouse, 101-key keyboard
- MS-DOS & Windows for Workgroups
- Microsoft Works Multimedia CD*
- Microsoft Encarta® CD
- Quicken® CD Deluxe Edition
- On-line trial services: Compuserve, Prodigy and America On-Line
- 3 LucasArts CD games: Rebel Assault Indiana Jones & Day of the Tentacle

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Compaq Computer Corp.

EDITORS' CHOICE

Compaq Presario CDS 520 Model 420

The $1,957 Am486SX2/66-based Compaq Presario CDS 520 Model 420—with 14-inch monitor—is all one piece and is very easy to set up. Compaq makes setup even

easier by including a quick-setup guide and a demonstration video. Telephony capabilities and bundled software make the ISA-based Presario an excellent home system.

The unit's motherboard integrates a modem, graphics, and sound chip sets. Its two-thumbscrew case and slide-out motherboard chassis simplify internal access. Though there are two available 16-bit ISA slots on a riser card, there are no additional free drive bays. The system integrates speakers and a microphone.

At startup, the Presario sets up preloaded software (including TabWorks, Compaq's Windows front end) and allows you to configure the Compaq Operator's message center. The system can be used as a phone, fax, and answering machine.

The Presario had below-average scores on all tests except the DOS Video tests, where its score was average. Its bundled software included Quicken, several children's titles, and a Quickbooks for Windows trial.—*WPF*

SUITABILITY TO TASK	Compaq Presario CDS 520 Model 420
Educational/Reference	FAIR
Entertainment	FAIR
Productivity	GOOD
Setup	EXCELLENT
VENDOR SERVICE & RELIABILITY	
Reliability	ABOVE AVERAGE
Repair service	ABOVE AVERAGE
Technical support	ABOVE AVERAGE

▶ Compaq Computer Corp., *Houston, TX; 800-345-1518; fax, 713-378-1442.*

Circle 456 on reader service card

Data Storage Marketing Inc.

• Data Storage Delta 75VL

What may make Data Storage's Delta 75VL VL-Bus system attractive to many users is its price, a very competitive $1,875. As a home PC, however, it doesn't quite measure up simply because it lacks many of the niceties other systems pro-

vide, such as a guide to ease setup headaches and answer questions before they're asked. The Delta also lacks simple touches such as labeled ports to show new users exactly where each cable should go.

To help novices, the Delta Series has Windows for Workgroup's Windows tutorial. The bundled software is more oriented toward the family than a small or home office: The only CD-ROM-based productivity package is Action! Presentation Kit, although Microsoft Works is preloaded. Additional software includes Indiana Jones and the Fate of Atlantis and Software Toolworks' encyclopedia. The company picks six CDs that are currently popular to ship with its systems, so your CD bundle may be different from ours.

Data Storage Delta was the only system in this roundup based on the 75-MHz IBM Blue Lightning Chip; a Cyrix math coprocessor was also installed. Its Winstone 95 and Disk WinMark 95 scores were average, but its Graphics WinMark 95 score slipped below average. Scores on our DOS-based tests were competitive except for a below-average DOSMark score.—*WPF*

SUITABILITY TO TASK	Data Storage Delta 75VL
Educational/Reference	POOR
Entertainment	EXCELLENT
Productivity	GOOD
Setup	POOR

▶ Data Storage Marketing Inc., *Boulder, CO; 800-543-6098, 303-442-4747; fax, 303-442-7985.*

Circle 458 on reader service card

Dell Computer Corp.

• Dell Dimension 466/V

At $2,299, the Dell Dimension 466/V is an affordable 486DX2/66-based PC with a bundle of productivity software that makes it well suited to the home office. But the system's lack of L2 cache dragged down its performance.

The unit was well packaged; all accessories and manuals were immediately available. All ports were labeled and the setup was relatively easy, though the inclusion of a setup guide would have helped. In Windows, Dell includes a Windows tutorial and technical support numbers. Dell includes a modem but our tested system had none of the fax and answering machine capabilities—or actual phone support—offered by others tested. Microsoft Office, which includes Excel and Word, was preloaded on the system, along with Quicken. The only bundled CD-ROM software included was Microsoft Bookshelf.

The Dimension's performance on our tests was very poor. Because it lacked an L2 cache, its $CPUmark_{16}$ score was the lowest of the group. The absence of cache adversely influenced other scores as well. The unit posted the lowest Winstone score of the group; most remaining Windows and DOS-based test results were also well below average.—*WPF*

SUITABILITY TO TASK	Dell Dimension 466/V
Educational/Reference	POOR
Entertainment	POOR
Productivity	GOOD
Setup	GOOD
VENDOR SERVICE & RELIABILITY	
Reliability	ABOVE AVERAGE
Repair service	ABOVE AVERAGE
Technical support	ABOVE AVERAGE

▶ Dell Computer Corp., *Austin, TX; 800-613-3355, 512-338-4400; fax, 800-727-8320.*

Circle 459 on reader service card

EPS Technologies Inc.

• EPS Mega Multi-Media

The $1,795 EPS Mega Multi-Media has one of the best family-oriented CD-ROM packages in this review, and it's a relatively strong performer for the price. The only significant shortcoming of the system is its lack of a setup guide to help

new users through the process of putting the system together—a prospect which can be intimidating at first.

This desktop system is based on a 486DX2/66 CPU. Two of the motherboard's PCI slots are available, and three of the system's drive bays are free. The unit is also one of only two in this review to include 16MB of RAM. Telephony capabilities include fax-forwarding and answering machine options. This was one of the few units reviewed that included an AC adapter with the speakers, something that usually requires a trip to the store and another purchase. On our benchmark tests, the EPS Mega's Winstone 95 score was above average. Its scores on the remaining tests were all average.

The EPS systems bundled reference titles such as Compton's New Century Encyclopedia and ToolWorks Reference Library. Game titles bundled with the unit included Terminator 2 and Software ToolWorks Challenge Game Pack, which contains a number of different games.—*WPF*

SUITABILITY TO TASK	
EPS Mega Multi-Media	
Educational/Reference	EXCELLENT
Entertainment	EXCELLENT
Productivity	EXCELLENT
Setup	POOR

▶ EPS Technologies Inc., *Jefferson, SD; 800-447-9021, 605-966-5586; fax, 605-966-5482.*
Circle 460 on reader service card

▶ SUMMARY OF FEATURES CONTINUES

Home PCs

List price (tested configuration) For companies that sell through dealers or resellers, street prices average 10 to 15 percent less than the list price. Some companies factor this discount into their quoted prices; in such cases, we indicate that the listed price is an estimate.

Installed/maximum motherboard RAM We list the amount of RAM installed in the tested system and the maximum amount of RAM supported.

Installed/maximum external RAM cache We list the amount of processor cache installed in the tested system and the maximum amount of processor cache supported.

We indicate the **BIOS manufacturer and version (or date)** for each system. The BIOS may affect a unit's performance on PC Magazine Labs' benchmark tests.

Flash BIOS replaces conventional ROM storage and can be electronically reprogrammed, making the BIOS upgradable. A **16550 UART chip** assists in high-speed serial communications.

Expansion-bus slots indicates the number and type of slot included in each system we reviewed. For systems with ISA and VL-Bus slots, we count ISA slots as only those slots that do not have a VL-Bus extension. If a system contains a shared ISA/PCI slot, that slot is counted as both an ISA and a PCI slot.

Graphics adapter (and memory) indicates which graphics card or chip set is used in the tested system and how much graphics memory is provided.

Hard disk capacity and interface describes the hard disk subsystem that came with our tested unit. In this roundup, each system used an IDE interface between the hard disk and the controller.

We indicate the model and speed of the **CD-ROM drive** on each tested system. A double-speed drive is represented as 2x and a triple-speed as 3x.

Speakers lists the manufacturer and model of the speakers included with the configuration we tested. Although we did not require speakers for this review, all vendors included them with their systems.

A **box-topper,** if included, is located inside the shipping box and provides step-by-step system setup instructions.

A **Windows front end** is a proprietary graphical user interface designed to run on top of Windows.

Dealers/Direct-distribution channel indicates whether a system is sold through authorized dealers or company-owned stores or offered directly by mail order.

Warranty on parts/labor All vendors include at least a one-year parts-and-labor warranty with their systems.

FutureTech Systems Inc.

• FutureTech System 4414

For the family, FutureTech's VL-Bus-based System 4414 offers a lot of hardware—including a video capture board—as well as a well-rounded software bundle, all for a relatively competitive $2,099.

The FutureTech 4414 offers little guidance on system setup, although its back-panel ports are labeled. It also comes with few of the intangible amenities we expect in a true home PC: Among other things, there is no Windows tutorial or CD-ROM loaded with all the system's software and configuration settings.

One of the unusual components in-

stalled in the system is a combination television and video capture board from PixelTech. With a cable hook up, this board lets you watch television *and* capture and edit what's on the screen with the help of an included video-editing package. Other bundled software in-

▶ SUMMARY OF FEATURES

Home PCs

PC MAGAZINE

Products listed in alphabetical order ■ = YES □ = NO	AcerPower 951ZTG	ACMA P60 MPC	ALR Multimedia Express M466D	AT&T Globalyst 300 TPC	Blackship Atlantis	Compaq Presario CDS 520 Model 420	CompuAdd C466D	Data Storage Delta 75VL
List price (tested configuration)	$2,598	$2,499	$2,344	$2,199	$1,795	$1,957 (est.)	$2,362	$1,875
Processor	Intel Pentium/60	Intel Pentium/60	Intel 486DX2/66	Intel 486DX2/66	Intel 486DX2/66	AMD Am486SX2-66	Intel 486DX2/66	IBM BL 25/75
Installed/maximum motherboard RAM	8MB, 128MB	8MB, 128MB	8MB, 36MB	8MB, 64MB	8MB, 64MB	8MB, 64MB	8MB, 64MB	8MB, 64MB
Installed/maximum external RAM cache	256K, 256K	256K, 256K	128K, 256K	None, 256K	256K, 256K	None, None	128K, 256K	256K, 256K
Motherboard manufacturer	Acer	Intel	ALR	AT&T	Blackship	Compaq	Micronics	IBM
Chip set manufacturer	Intel	Intel	ALI	SIS	SIS	VLSI	Micronics	OPTi
BIOS manufacturer and version (or date)	Acer (8/25/94)	AMI (4/15/94)	IBM (8/18/94)	Award (7/27/94)	Award (7/26/92)	Compaq (8/5/94)	Phoenix (1/15/88)	IBM (10/24/93)
Flash BIOS/16550 UART chip	■□	■■	■□	□□	□■	■■	■■	□■
Expansion-bus slots	5 ISA, 3 PCI	5 ISA, 3 PCI	3 ISA	4 ISA, 2 VL	4 ISA, 3 VL	2 ISA	5 ISA, 2 VL	5 ISA, 2 VL
Parallel, serial, mouse ports	1, 2, 1	1, 2, 0	1, 2, 1	1, 2, 0	1, 2, 0	1, 1, 1	1, 2, 0	1, 2, 0
Graphics adapter (and memory)	ATI Mach32-based (2MB)	Diamond Stealth 64 (1MB)	Integrated Cirrus Logic CL-GD5428 (1MB)	AT&T PWA-MVGA-542X (1MB)	Cirrus Logic GD5428-based (1MB)	Integrated Cirrus Logic CL-GD5424 (512K)	Western Digital Paradise (1MB)	Diamond SpeedStar Pro (1MB)
Hard disk capacity and interface	548MB IDE	540MB IDE	424MB IDE	424MB IDE	426MB IDE	422MB IDE	424MB IDE	405MB IDE
CD-ROM drive (and speed)	Mitsumi CRMC-FX00IDE (2x)	Panasonic CR-562-B (2x)	Wearnes CDD-110 (2x)	Sony CDU 33A (2x)	IBM/Panasonic CR-562 (2x)	Matsushita CR-571-C (2x)	Mitsumi Fx001D (2x)	Aztech CDA-268-01a (2x)
Speakers	Acer Speakers	ACMA 80-Watt	MIDI Land MLi 168	AT&T Talkback	QuickShot Sound Mate 4	Integrated Compaq/ Panasonic	LabTec MCS-600	Aztech AZT18
Audio/Microphone/Headphones	■□□	■■□	■□□	■■□	■□□	■■□	■■□	■■□
Modem/TV board/Radio	■□□	■□□	■□□	■□□	■□□	■□□	■□□	■□□
Box-topper/Getting-started video/ Windows front end	■□■	■□■	■□■	■■■	□□□	■■■	□□■	■□□
Labeled ports/Color-coded cables	■□	■□	■□	■□	■□	■□	□□	□□
Accessible drive bays (5.25", 3.5")	3, 2	3, 2	1, 1	2, 2	2, 2	1, 1	3, 2	3, 2
Internal drive bays (5.25", 3.5")	0, 2	0, 1	1, 1	0, 1	0, 2	0, 1	0, 2	0, 0
Power supply (and number of connectors)	200W (3)	250W (6)	125W (3)	200W (5)	235W (3)	150W (3)	200W (5)	250W (4)
Monitor (and diagonal screen size)	Acer View 58L (15")	Impression 5528NG (15")	MAG Innovision Dx15F (15")	AT&T/NCR CAM630Z (14")	MGC 1586VA (15")	Integrated Compaq 177018.001 (14")	CompuAdd TE1564M (15")	ViewSonic/Data Storage 6E (14")
System software	DOS 6.22, Windows 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, Windows 3.11	DOS 6.22, Windows 3.11	DOS 6.22, WfWG 3.11	DOS 6.2, Windows 3.1	DOS 6.2, WfWG 3.11	DOS 6.22, WfWG 3.11
Dealers/Direct-distribution channel	□■	■■	■■	■■	□■	■□	□□	■■
Warranty on parts/labor	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	3 years/3 years	1 year/1 year	3 years/3 years
On-site service (1 year)	Included	Included	$9.95	Included	Included	Included	Included	$50.00

N/A—Not applicable: The vendor does not offer on-site service

ALI—Acer Labs Inc., ALR—Advanced Logic Research Inc., AMI—American Megatrends Inc., BCM—BCM Advanced Research Inc., SIS—Silicon Integrated Systems Corp., UMC—United Microelectronics Corp., VLSI—VLSI Technology Inc.

cludes The Software Toolworks Challenge Pack, Compton's Interactive Encyclopedia, and The Software Toolworks World Atlas.

The FutureTech 4414's Winstone 95 score was average; its Graphics WinMark 95 and Disk Winmark 95 scores were below average.—*WPF*

SUITABILITY TO TASK FutureTech System 4414	
Educational/ Reference	GOOD
Entertainment	POOR
Productivity	GOOD
Setup	POOR

▶ FutureTech Systems Inc., *Hackensack, NJ; 800-275-4414, 201-488-4414; fax, 201-488-4405.*

Circle 461 on reader service card

Gateway 2000 Inc.

• Gateway 2000 P5-60 Family PC

The $2,499 Gateway 2000 P5-60 Family PC, an above-average performer, provides a wealth of user assistance and easy access to hardware information, plus a strong home-oriented software bundle.

The Gateway Family PC's full-color documentation is clear and easy to follow; it even notes what each of the black-and-white spotted "cow boxes" should contain. An "Important Stuff" folder includes a mouse pad, warranty and on-site service information, a system manual, and information on CompuServe's Gateway Forum.

At bootup, you're taken to Windows and shown a short video before being dropped into Program Manager. A Gateway 2000 program group contains guides for the installed 14.4-kilobit-per-second

CONTINUES

Dell Dimension 466/V	EPS Mega Multi-Media	FutureTech System 4414
$2,299	$1,795	$2,099
Intel 486DX2/66	Intel 486DX2/66	Intel 486DX2/66
8MB-64MB	16MB-512MB	8MB-128MB
None-256K	256K-512K	256K-512K
Dell	EPS	Asus
OPTi	UMC	SIS
AMI Dell (11/11/92)	Award (8/18/94)	Award (4/26/94)
☐☐	☐■	■☐
3 ISA-2 VL	2 ISA-4 PCI-2 VL	5 ISA-2 VL
1, 2, 1	1, 2, 0	1, 2, 0
Integrated Cirrus Logic CL-GD5428 (512K	ATI WinTurbo 64 (2MB)	Jax Tech VI 41 (2MB)
528MB IDE	528MB IDE	341MB IDE
Panasonic CR-563 x (2x)	Mitsumi FX001D (2x)	Mitsumi FX001d2 (2x)
Peavey MediaVoice 200A	LabTech CS-1400	Hi-Tex CP-18
■☐☐	■■☐	■☐☐
■☐☐	■☐☐	■■☐
☐☐■	■☐☐	☐☐☐
☐☐	■☐	■☐
3.0	2.2	3.2
0.2	2.0	2.0
150W (3)	200W (3)	250W (5)
Dell VS15 (15")	Hitachi SuperScan 15s (15")	Socos DCM-1588-E (15")
DOS 6.2, Windows 3.1	DOS 6.22, WfWG 3.11	DOS 6.2, Windows 3.11
☐■	■■	☐■
1 year/1 year	3 years/1 year	15 months/15 months
Included	Included	$49.00

fax modem and ATI graphics card, as well as a glossary, general customer information, and an animated "System Basics" on-line guide. In case of major problems, a Gateway system CD can be used to restore the system's original settings. Other bundled CDs include Microsoft's Works for Windows, Encarta, and Money.

SUITABILITY TO TASK	Gateway 2000 P5-60 Family PC
Educational/Reference	FAIR
Entertainment	FAIR
Productivity	EXCELLENT
Setup	POOR
VENDOR SERVICE & RELIABILITY	
Reliability	ABOVE AVERAGE
Repair service	ABOVE AVERAGE
Technical support	ABOVE AVERAGE

This PCI-based unit had above-average scores on our Graphics WinMark 95 and Disk WinMark 95 tests.—*Robert S. Anthony*

▶ Gateway 2000 Inc., *North Sioux City, SD; 800-846-2000, 605-232-2000; fax, 605-232-2023.*

Circle 462 on reader service card

IBM Personal Computer Co.

• IBM Aptiva 530 PC Model 530

IBM's $2,398 Aptiva 530 PC Model 530 has been promoted with great fanfare; its excellent documentation and on-line help are

appealing, but its laggard performance overall makes it only an average home PC.

As a plus, user help is everywhere—even the inside flaps of the boxes containing the system unit and the monitor give a toll-free assistance number, unpacking instructions, and a list of contents.

On bootup, you'll go to IBM's Windows-based front-end. It offers t 'orials, technical help, and other useful atures such as the Aptiva Index, which s over 200 tasks you can perform with ☐ and details instructions on how to ıem. With the preinstalled voice-rec tion software and included microphone, the IBM Aptiva 530 can be trained to respond to common Windows commands. We tested a $499 IBM 15-inch monitor for this review, but the IBM Aptiva 530 is sold alone; you must purchase a monitor separately.

SUITABILIT O TASK	IBM Apti 530 PC Mod 530
Educational/Reference	ELLENT
Entertainmen	OOD
Productivity	FAIR
Setup	EXCELLENT
VENDOR RELIA RVICE & ILITY	
Reliability	ABOVE AVERAGE
Repair service	ABOVE AVERAGE
Technical support	ABOVE AVERAGE

Unfortunately, the VL-Bus–based IBM Aptiva 530 logged below-average scores on all our tests, except the DOS Video tests, where its score was average. The likely culprit: a lack of L2 cache.—*RSA*

▶ IBM Personal Computer Co., *Somers, NY; 800-426-3377.*

Circle 463 on reader service card

Insight Direct Inc.

• Insight PCI P60 MM

The $2,499 Insight PCI P60 MM provides a new user with a quick start into multimedia computing—if he has some idea how to set up a computer. While the system

performed competitively and comes with excellent multimedia software and large speakers, help was hard to locate.

The Insight MM includes a "welcome" envelope, but it contains only an Insight mail-order catalog, technical-support numbers for more than 100 PC peripheral vendors, and an index card to record your PC's serial number and other data. At startup, you're taken to Windows for Workgroups, where you can configure the operating system for your printer.

What makes the Insight MM system interesting is the Reveal Multimedia Upgrade kit, which includes 35 multimedia CD-ROM titles, a joystick, headphones, a microphone, and stereo speakers. The Reveal Kit even included a setup video, but it was unnecessary since the kit's double-speed CD-ROM drive and Sound-FX sound card are preinstalled by Insight. Also prein-

SUITABILITY TO TASK	Insight PCI P60 MM
Educational/Reference	EXCELLENT
Entertainment	EXCELLENT
Productivity	GOOD
Setup	FAIR
VENDOR SERVICE & RELIABILITY	
Reliability	ABOVE AVERAGE
Repair service	ABOVE AVERAGE
Technical support	AVERAGE

SUMMARY OF FEATURES

Products listed in alphabetical order ■ = YES □ = NO	Gateway 2000 P5-60 Family PC	IBM Aptiva 530 PC Model 530	Insight PCI P60 MM	Micron P90 Home MPC	MidWest Micro Elite Home PC P5-90	NEC Ready P60M	NETIS Pentium N566 Best Buy
List price (tested configuration)	$2,499	$2,398 (est.)	$2,499	$2,499	$2,699	$2,794 (est.)	$2,650
Processor	Intel Pentium/60	Intel 486DX2/66	Intel Pentium/60	Intel Pentium/90	Intel Pentium/90	Intel Pentium/60	Intel Pentium/66
Installed/maximum motherboard RAM	8MB, 128MB	8MB, 128MB	8MB, 128MB	8MB, 192MB	8MB, 128MB	8MB, 136MB	8MB, 192MB
Installed/maximum external RAM cache	256K, 256K	None, 256K	256K, 256K	256K, 512K	256K, 256K	256K, 256K	256K, 512K
Motherboard manufacturer	Intel	IBM	Intel	Micronics	Intel	NEC	Asus
Chip set manufacturer	Intel	OPTI	Intel	Intel	Intel	Intel	Intel
BIOS manufacturer and version (or date)	AMI (5/18/94)	IBM (8/16/94)	AMI (4/15/94)	Phoenix (8/25/94)	AMI (7/22/94)	AMI (6/22/94)	Award (7/7/94)
Flash BIOS/16550 UART chip	■■	■■	■■	■■	■■	■■	■■
Expansion-bus slots	5 ISA, 3 PCI	3 ISA, 1 VL	5 ISA, 3 PCI	5 ISA, 3 PCI	5 ISA, 3 PCI	4 ISA, 2 PCI	5 ISA, 3 PCI
Parallel, serial, mouse ports	1, 2, 1	1, 2, 1	1, 2, 0	1, 2, 1	1, 2, 0	1, 2, 1	1, 2, 0
Graphics adapter (and memory)	STB 5430 (1MB)	Integrated Cirrus Logic CL-GD5430 (1MB)	ATI Mach32-based (2MB)	Diamond Stealth 64 PCI (2MB)	ATI WinTurbo (2MB)	Integrated Cirrus Logic CL-GD5434 (1MB)	ATI WinTurbo (2MB)
Hard disk capacity and interface	729MB IDE	424MB IDE	428MB IDE	527MB IDE	428MB IDE	425MB IDE	424MB IDE
CD-ROM drive (and speed)	NEC CDR-260 (2x)	IBM/Mitsumi CRMC-FXN01DE (2x)	Panasonic CR-563-B (2x)	Mitsumi FX001D (2x)	Mitsumi FX001D (2x)	NEC MultiSpin 3Xi (3x)	Mitsumi FX001D (2x)
Speakers	Yamaha YST-M10	Jazz Hipster J-590 AV	Reveal RS380	Koss HD/4	Altec Lansing Multimedia ACS 50	Labtec CS-150	Media Active SP-690
Audio/Microphone/Headphones	■□□	■■□	■■■	■□□	■□□	■■□	■□□
Modem/TV board/Radio	■□□	■□□	■□□	■□□	■□□	■□□	■□□
Box-topper/Getting-started video/ Windows front end	■□■	■□■	■□■	■□■	□□□	□■■	■□□
Labeled ports/Color-coded cables	■□	■□	■□	■□	■□	■□	■□
Accessible drive bays (5.25", 3.5")	3, 1	1, 1	3, 2	3, 1	3, 2	3, 1	3, 2
Internal drive bays (5.25", 3.5")	0, 0	0, 2	0, 1	0, 2	0, 2	0, 2	0, 0
Power supply (and number of connectors)	145W (5)	145W (3)	200W (4)	200W (4)	230W (6)	200W (4)	250W (5)
Monitor (and diagonal screen size)	Gateway 2000 CS1572DG (14")	IBM 15R MS (14")	MAG Innovision DX15F (15")	MAG Innovision LX1450LG (14")	Infotel SRC1502 (15")	NEC 3V (15")	ETC CA-15CG (15")
System software	DOS 6.22, WfWG 3.11	IBM PC DOS 6.3, Windows 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, Windows 3.1	DOS 6.22, WfWG 3.11
Dealers/Direct-distribution channel	□■	■■	□■	□■	■■	■■	■■
Warranty on parts/labor	3 years/3 years	3 years/3 years	1 year/1 year	1 year/1 year	3 years/3 years	3 years/3 years	1 year/1 year
On-site service	N/A	N/A	N/A	Included	N/A	Included	Included

N/A—Not applicable: The vendor does not offer on-site service.
ALI—Acer Labs Inc., ALR—Advanced Logic Research Inc., AMI—American Megatrends Inc., BCM—BCM Advanced Research Inc., SIS—Silicon Integrated Systems Corp., UMC—United Microelectronics Corp., VLSI—VLSI Technology Inc.

stalled on the system are on-line service software and sound board utilities.

The Insight MM's performance was average.—*RSA*

▶ Insight Direct Inc., *Tempe, AZ; 800-729-0770, 602-902-1176; fax, 602-902-1180.*

Circle 464 on reader service card

Micron Computer Inc.

• Micron P90 Home MPC

A stellar performance and a user-friendly Windows front-end utility help make the $2,499 Micron P90 Home MPC—a Pentium/90 machine with a PCI bus—a home computing system that won't make you compromise on performance.

The midsize-tower system comes with small Koss stereo speakers, a joystick and several software titles including Microsoft Works, Delrina's WinFax LITE, Quicken Deluxe Edition, and Rebel Assault.

A sheet outlines how to unpack the system unit and a helpful "Read Me First" booklet provides a map of all ports and offers a nine-step quick-setup guide. After turning on the machine, you're taken directly to Windows and the Phoenix Home Office Environment, developed by Phoenix Technologies Ltd.

The Micron P90 had the top Disk WinMark 95, Graphics Win-

SUITABILITY TO TASK	Micron P90 Home MPC
Educational/ Reference	FAIR
Entertainment	FAIR
Productivity	EXCELLENT
Setup	GOOD
VENDOR SERVICE & RELIABILITY	
Reliability	ABOVE AVERAGE
Repair service	ABOVE AVERAGE
Technical support	ABOVE AVERAGE

ENDS

PC MAGAZINE Editors' Choice				
Packard Bell 486DX2/66 Multimedia System	**PC Express Family Multimedia System**	**Robotech Cobra RS Home Runner p60**	**Tagram Platinum I**	**USA Flex Family Edition**
$2,200 (est.)	$1,999	$2,499	$2,449	$1,995
Intel 486DX2/66	Intel 486DX2/66	Intel Pentium/60	Intel Pentium/60	Intel 486DX2/66
8MB/64MB	8MB/64MB	16MB/128MB	8MB/128MB	8MB/64MB
None, 512K	128K, 256K	512K, 2MB	256K, 512K	256K, 512K
Packard Bell	Asus	Robotech	BCM	USA Flex
OPTi	SIS	Forex	Intel	SIS
Phoenix (6/23/94)	Award (4/26/94)	Award (7/19/94)	Phoenix (9/16/93)	Award (3/23/94)
■■	□□	■□	□■	□■
3 ISA	5 ISA, 2 VL	4 ISA, 3 VL	5 ISA, 3 PCI	4 ISA, 3 VL
1, 2, 1	1, 2, 0	1, 2, 0	1, 2, 0	1, 2, 0
Integrated Cirrus Logic CL-GD5428 (1MB)	Hercules Stingray VL-1 (1MB)	Genoa Hornet VGA 8300VL (1MB)	Diamond Stealth 64 PCI (2MB)	Hercules Stingray VL-1 (1MB)
539MB IDE	427MB IDE	404MB IDE	528MB IDE	425MB IDE
Panasonic CR-563-B (2x)	Sony CDU 33A (2x)	Panasonic CR-563 (2x)	Mitsumi FX0001D (2x)	Sony CDU 33A (2x)
Packard Bell SPK-229	Laser Station S80GT	Creative Labs SBS38	Integrated Proton GM-1563M	Micro Innovations MM40P
■□□	■■□	■■□	■■□	■□■
■■□	■□□	■□□	■□□	■□□
■□■	□□■	■□■	■■■	□□□
■■	■□	■□	■□	■□
1, 1	3, 2	3, 1	2, 1	3, 2
0, 1	0, 3	0, 1	1, 2	0, 2
150W (3)	230W (4)	230W (4)	250W (5)	200W (3)
Packard Bell 1511SL (15")	CTX 1451ES (14")	Tatung CM15VBE (15")	Proton GM-1565M (15")	CTX 1562GM (15")
DOS 6.2, WfWG 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11	DOS 6.22, WfWG 3.11
■□	■■	■■	■■	□■
1 year/1 year	5 years/5 years	2 years/2 years	3 years/3 years	3 years/3 years
Included	$79.00	Included	$30.00	$49.00

Mark 95, DOS Disk, and DOSMark scores of all the units we reviewed in this roundup.—*RSA*

▶ Micron Computer Inc., *Nampa, ID; 800-388-6334, 208-465-3434; fax, 208-465-3424.*

Circle 465 on reader service card

MidWest Micro

• MidWest Micro Elite Home PC P5-90

While it offered adequate assistance for novice users as well as a good supply of application software, MidWest Micro's $2,699 Elite Home PC P5-90 did not have the kind of performance we expected to see from a Pentium/90-based machine.

The PCI-based mini-tower system includes an illustrated, 100-page user manual which offers brief but adequate overviews on how to set up and maintain the system. Ports are unlabeled, however. Fortunately, the manual has illustrations to help users identify each port. Also included with the unit was a 14.4-kilobit-per-second fax modem.

A number of Microsoft applications, including Encarta, Money, and Works for Windows, were provided. The MidWest Elite also came with a Media Vision Pro AudioSpectrum 16 sound board and a pair of diminutive but high-quality speakers.

SUITABILITY TO TASK	MidWest Micro Elite Home PC P5-90
Educational/Reference	POOR
Entertainment	POOR
Productivity	GOOD
Setup	POOR

Not only was the MidWest Elite's Winstone 95 score surpassed by the other Pentium/90 machines reviewed here, it was also bettered by most of the Pentium/60 machines and one 486DX2/66 machine as well. On the other hand, the system did post one of the highest Graphics WinMark 95 scores in this roundup. The unit's Disk WinMark 95 score was average.—*RSA*

▶ MidWest Micro, *Fletcher, OH; 800-682-7256, 513-368-2309; fax, 800-562-6622.*

Circle 466 on reader service card

NEC Technologies Inc.

• NEC Ready P60M

NEC Technologies aptly named this $2,794 Pentium/60-based PC the NEC Ready P60M—as soon as you go through the brief but clear setup instructions or view the included video, you're ready to get started. The unit has competitive performance and features a triple-speed CD-ROM drive and PCI expansion bus.

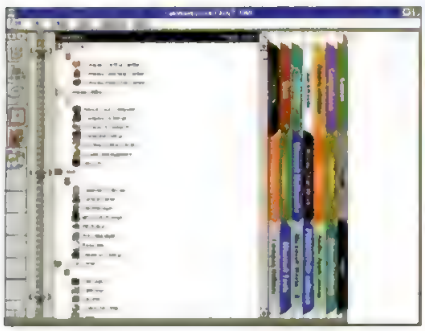
Among the enclosed items are four pages of quick-setup information, a clearly written system manual, and a system setup video specific to the NEC Ready which outlines all cable connections. The video also provides technical support informa-

Windows Front Ends

By Carol Venezia

The burgeoning home computer market has brought with it the advent of many vendor-specific, often user-customizable Windows front-end programs and software utilities. For those who are unfamiliar with computers, a Windows front end is basically a separate program that runs on top of or in conjunction with Windows. These front ends are designed to be as user-friendly as possible, and they can be rather helpful in guiding novice computer users through Windows and the many features of a new system.

All of the Windows front ends described here offer the user some degree of on-line help, including Windows tutorials and basic system information as well as system setup. But if you're already an experienced computer user, are these extra layers of software really that helpful, or are they just another piece of software that takes up precious space on your hard disk that you may need for something else? See for yourself. □



Compaq's TabWorks **puts all your Windows applications at your fingertips. All you have to do is click on one of the tabs, select an item on the corresponding page, and you can launch anything on your system from a Windows program to a Compaq utility or an on-line help session. A user-customizable toolbar also allows for quick and easy access to frequently used programs.**

A.C.E. **(The Acer Computer Explorer) gives you easy access to system and registration information, and allows you to launch Windows programs by clicking one of the user-customizable buttons. If you need technical assistance, the A.C.E. program group includes an item called "Need More Help?" which displays Acer's toll-free technical support number and your PC's serial number.**

If the endless jumble of computer-speak often leaves you scratching your head in wonder, all you have to do is look to the handy *Dell Computer Glossary*. Clicking on one of the letters at the top activates a list of computer terms beginning with that letter. Then simply select a word from the list, and a pop-up window with the definition appears.

With *IBM's AptivaWare Personal Desktop* utility, you don't have to worry about your children accidentally deleting one of your personal files or viewing something that they shouldn't see. By selecting the Children Personal Desktop, only the programs you choose—be they educational or recreational in nature—will be available for use by your children.

The *Micron Home Office*, from Phoenix Technologies, is just that: a graphical depiction of a typical home office, including a fax machine, calendar, bookshelves, and a PC. By clicking on different objects, you can start up applications, send a fax, or turn on your system's sound. To reassign a different program to an object, just click on the Rubik's Cube.

The *Packard Bell Navigator* uses icons and interactive scenery. It includes Workspace, which organizes files and programs into folders, and Kidspace, an animated environment for children. The main screen can be set up to look like a hallway with doors leading to darkened rooms. The rooms, which access parts of Navigator, light up as the cursor enters a doorway.

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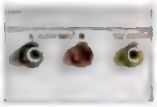

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PC MAGAZINE EDITORS' CHOICE
June 28, 1994
Tagram Thunderbolt XL

intel inside

CD SELECTIONS

The Reference Pack
Grolliers Encyclopedia
Mayo Clinic Family Health Book
Electronic Cookbook
American Heritage Dictionary
Jurassic Park CD-Screen Saver

The Fun Pack
CD Game Pack (9 Games)
7th Guest
Iron Helix
Mega Race
Jurassic Park CD-Screen Saver

PLATINUM I

- TEAC 4X CD-ROM Drive
- Orchid Game Wave 32 DSP Wavetable
- 64 bit PCI Diamond Stealth 64 Graphics
- "Mode 3" Enhanced IDE & Fast IO Ports
- 9600 Voice/Fax/Data Modem
- 256K Write Back Cache
- Choice of One CD Package
- 1.44MB Floppy Drive/Keyboard/Mouse
- MS-DOS & Windows for WorkGroups
- Desktop Case, 3 PCI, 2 VLB, 3 ISA

A IntelDX2™ 66MHz, 4MB RAM/420MB HD, 1MB DRAM, Proton 14" .28 NI Monitor
$1899

B Pentium™ 60MHz, 8MB RAM/540MB HD, 1MB DRAM, Proton 15" Multimedia Monitor
$2449

C Pentium™ 90MHz, 16MB RAM/540MB HD, 2MB DRAM, Proton 15" Multimedia Monitor
$2999

PLATINUM II

- 2X CD ROM Drive
- 16 bit SoundBlaster Compatible Sound Card
- PCI W32P Graphics Accelerator
- "Mode 3" Enhanced IDE & Fast IO Ports
- 9600 Voice/Fax/Data Modem
- 256K Write Back Cache
- Choice of One CD Package
- 1.44MB Floppy Drive/Keyboard/Mouse
- MS-DOS & Windows for WorkGroups
- Mini-Desktop or Desktop Case

A IntelDX2™ 66MHz, 4MB RAM/420MB HD, 1MB DRAM, Proton 14" .28 NI Monitor
$1599

B Pentium™ 60MHz, 8MB RAM/540MB HD, 1MB DRAM, Proton 15" Multimedia Monitor
$2199

C Pentium™ 90MHz, 8MB RAM/540MB HD, 2MB DRAM, Proton 15" Multimedia Monitor
$2459

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CIRCLE 090 ON READER SERVICE CARD

SUITABILITY TO TASK	NEC Ready P60M
Educational/ Reference	FAIR
Entertainment	POOR
Productivity	FAIR
Setup	FAIR
VENDOR SERVICE & RELIABILITY	
Reliability	AVERAGE
Repair service	AVERAGE
Technical support	AVERAGE

tion, including how to set up the machine for remote diagnostics.

NEC provides a CD-ROM disk containing a backup of the original system configuration. PFS:WindowWorks and trial software for America Online and CompuServe are among the unit's preinstalled utilities. Although NEC includes its popular triple-speed CD-ROM drive, it does not usually bundle a monitor. (NEC 15-inch monitors range in price from $495 to $655.)

The unit's benchmark test scores ranged from average to above average.—*RSA*

▶ NEC Technologies Inc., *Boxborough, MA; 800-632-4636, 508-264-8000; fax, 508-264-8831.*

Circle 467 on reader service card

NETiS Technology Inc.

• NETiS Pentium N566 Best Buy

The $2,650 NETiS Pentium N566 Best Buy might be considered a good second home computer, since you'll certainly need prior personal computer experience in order to set it up. While the Pentium/66-based NETiS system proved itself a worthy performer on our tests and came with all the hardware elements of a quality multimedia home PC, there was little guidance provided for a novice PC user.

SUITABILITY TO TASK	NETiS Pentium N566 Best Buy
Educational/ Reference	GOOD
Entertainment	FAIR
Productivity	GOOD
Setup	POOR

Once you open the system's box, you're basically on your own. The unit included manuals for components such as the ATI 64-bit graphics board, the 14.4-kilobit-per-second modem, the PCI-based motherboard, and the CD-ROM drive, but there was no overall system manual or setup sheet. Also, while the back of the system had labels near some of the ports, some labels were missing or were incorrectly placed.

Lack of documentation aside, the NETiS Best Buy did come with a pistol-grip joystick, adequate speakers, BitCom 1.0 and BitFax 2.0, and sound utilities for its Sound Blaster sound card. It also bundled half a dozen good CD-ROM software titles including Microsoft Bookshelf, The Software Toolworks World Atlas, and Where in the World is Carmen Sandiego?

The NETiS Best Buy performed well,

especially on the Disk WinMark 95 and Graphics WinMark 95 tests.—*RSA*

▶ NETiS Technology Inc., *Milpitas, CA; 800-577-7526, 408-263-0368; fax, 408-263-4624.*

Circle 468 on reader service card

Packard Bell Electronics Inc.

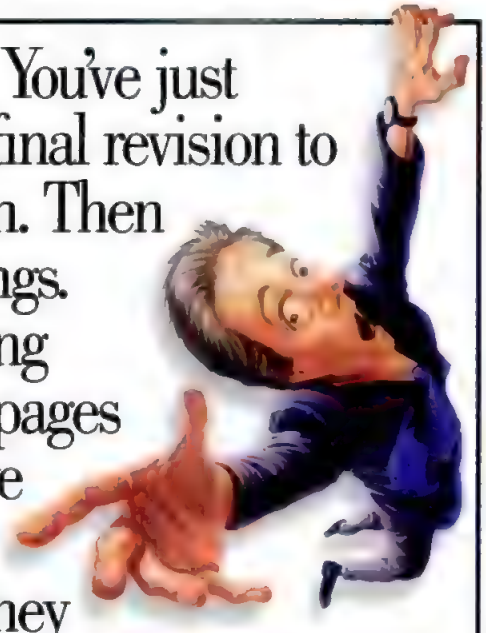
EDITORS' CHOICE

Packard Bell 486DX2/66 Multimedia System

PC novices may feel at home with the $2,200 Packard Bell 486DX2/66 Multimedia System. Quality documentation, color-coded cables, and friendly front-end soft-

ware combine to take any pain out of setting up this unit. Its monitor-mounted speakers, generous selection of CD-ROM software, and preinstalled television board make the Packard Bell 486DX2/66 a good value despite its lackluster performance.

It's 3:50 pm. You've just finished the final revision to the sales plan. Then the phone rings. "We're sending over 10 new pages of competitive info." Click. Good thing they lock the windows on this floor. You have to get it into the plan by the end of the day. What now?



Bundling the Difference

By Laura R. Cox

The PCs in our roundup came loaded with software in every category, from fun to finance, both preinstalled and bundled. Some companies were overly generous, such as Robotech, which included over 200 preinstalled shareware programs (using over 200MB of hard disk space) with its system. But quantity and quality don't always mix. Consider also that a PC may ship with 20 products, but you may actually receive only a few complete programs that include disks and a manual.

Companies such as AT&T Global Information Solutions, Dell Computer, IBM Personal Computer Co., Micron Computer, NEC Technologies, and Packard Bell Electronics provide a system CD-ROM that includes all of the preinstalled software and drivers on the system. Such a backup of your entire system is definitely recommended, and having it handed to you on a CD-ROM is a nice extra. But on that fateful day when you turn on your system and nothing happens, what can you do? Micron and Packard Bell's solution is a CD-ROM boot disk that allows you to boot up the computer and access the CD-ROM. IBM gives you the opportunity to create a boot disk with CD-ROM drivers on it. Most companies provide you with necessary operating system disks, such as DOS 6.22 and Microsoft Windows 3.1, which you'll need if you want to change your setup configuration. Companies that don't provide disks or a CD-ROM system backup (Acer America Corp., Insight Direct, and Packard Bell) have a proprietary interface for backing up operating system disks and other software.

BUNDLE MANIA

So which company has the best bundle? The Insight unit included 35 CD-ROM titles, which are part of the Reveal Quantum multimedia upgrade kit shipping with the system (Reveal won an Editors' Choice award in our issue of October 25, 1994). ACMA Computers' unit came with 12 CD-ROM titles, including The Lifestyle CD Pak, which features Better Homes & Gardens Complete Guide to Gardening and Home Cooking, and for the three- to eight-year-old crowd there's Humongous Entertainment's Putt-Putt Joins the Parade. Packard Bell's PC spells fun with a CD-ROM ten-pack that includes Knowledge Adventure's 3-D Dinosaur and a pair of 3-D glasses.

Software bundles can differentiate home PCs, but remember that quantity doesn't always mean quality.

Buyers shouldn't be overexcited by packaged deals. Several companies included The Software Toolworks Challenge Pack among their offerings. This single CD-ROM contains nine titles. It sounds like you're getting a lot, but you may not be thrilled with such selections as Paperboy2 and Contraption Z.

The MidWest Micro unit includes Microsoft Money, Knowledge Adventure's Dinosaur Adventure, and TestDrive, a CD-ROM that includes demos of 200 products you can order from SoftKey. Compaq Computer's unit ships with Microsoft Works and Microsoft Encarta, and also offers system-specific titles, such as How Does My Compaq Presario Answer the Phone?

HELPFUL HINTS

To help new users, ACMA, Compaq, and Dell offer proprietary computer glossaries. Compaq goes a step further with its software The Learning Center. It contains the Compaq User's Guide and tutorials on Microsoft Windows 3.1 and DOS. Data Storage Marketing uses Individual Software's Learn Windows, and AT&T offers Quick Cards (from Usability Science Corp.), which contains step-by-step instructions for certain tasks in Windows. Packard Bell has a Troubleshooter icon in its Packard Bell Program Group, which covers software, peripherals, and safety tips.

IBM offers its AptivaWare Personal Desktop utility, which includes Windows lessons, computer basics, system information, and lots more. AptivaWare also allows you to change your desktop for beginners and children.

FOR THE OFFICE

If your new computer will be used primarily in a home office, check out the Dell system. It comes preinstalled with Microsoft Office 4.2—a real bonus over systems that ship with Microsoft Works alone—PFS:WindowWorks, or ClarisWorks, which serve more modest needs.

The Quicken Windows Deluxe Edition, which shipped with Micron's system, includes extras such as Quicken Quotes, Quicken Home Inventory, and Quicken Tax Estimator and offers the best value for your business. CompuAdd also adds business value with Microsoft Publisher and Microsoft Money. If education is something you need to think about, all the systems we tested—except the ACMA PC—came with a multimedia encyclopedia. □

A box-top instruction sheet guides new users through basic setup. The monitor, mouse, and video cables are color-coded to match port labels on the back of the PC—a nice touch. Cable guides under the monitor keep speaker wires from getting tangled. The system features motherboard-integrate VL-Bus video but has only ISA expansion slots. It is bundled with an array of personal, business, and data/fax/voice software. At boot-up, you're taken directly to Packard Bell's Navigator front end for Windows, which instructs you by voice on how to use it.

SUITABILITY TO TASK	
Packard Bell 486DX2/66 Multimedia System	
Educational/Reference	GOOD
Entertainment	EXCELLENT
Productivity	GOOD
Setup	EXCELLENT
VENDOR SERVICE & RELIABILITY	
Reliability	BELOW AVERAGE
Repair service	BELOW AVERAGE
Technical support	BELOW AVERAGE

On most of our tests, the system only managed below-average scores. The unit lacked L2 cache (up to 512K is optional); its absence likely contributed to the PC's poor showing.—*RSA*

▶ Packard Bell Electronics Inc., *Westlake Village, CA; 800-733-4411, 818-865-0171; fax, 801-579-0092.*

Circle 469 on reader service card

PC Express Inc.

• PC Express Family Multimedia System

The $1,999 PC Express Family Multimedia System offers all of the hardware and software you'd want in a home multimedia PC, but it lacks guidance for new users. While the 486DX2/66-based unit was an adequate performer on our tests, only component manuals were sent—no system manuals or setup guides were included.

SUITABILITY TO TASK	
PC Express Family Multimedia System	
Educational/Reference	EXCELLENT
Entertainment	FAIR
Productivity	GOOD
Setup	POOR

The system came with a good selection of CD-ROM titles (including Chessmaster 4000 and Mavis Beacon Teaches Typing) and a number of basic business, on-line service, and communications applications.

This PC makes things easy for potential Internet surfers. Included is ExpressNet, a graphical Internet access utility which works with the World-Wide Web, and the book *Access the Internet,* by David Beal.

The unit is bundled with Boca Research's 14.4-kilobit-per-second Sound Modem, which integrates a data/fax/voice

modem, a Sound Blaster-compatible sound card, and a microphone on a single, full-length ISA board.

The system scored below average on most of our tests.—*RSA*

▶ PC Express Inc., *Ridgefield, MN; 800-937-1100, 612-861-5555; fax, 612-861-2425.*

Circle 470 on reader service card

Robotech Inc.

• Robotech Cobra RS Home Runner p60

The $2,499 Cobra RS Home Runner p60 from Robotech comes with a Pentium/60 CPU and a large assortment of software

(including a variety of interesting shareware games). A quick-setup guide and labeled ports make system setup easy.

The Robotech Cobra's Disk WinMark 95 score was above average; its Graphics WinMark 95 score was average. However, its Winstone 95 score was among the best of the group and noticeably better than two of

187 pages of legal briefs have just arrived at the office. On your desk. Apparently, your boss wants you to key them into his new client report. By 5:00 pm. For a moment, you wonder if life in prison without parole would be so bad after all. What now?

the three Pentium/90 systems in this roundup. The main reason for this above-average performance was the system's memory: It was tested with 16MB of RAM, while the majority of other systems had 8MB. The increased memory did not noticeably benefit the unit on our DOS-based tests, however, as its scores were average.

The Robotech Cobra's software bundle is one of the most unusual in this roundup.

SUITABILITY TO TASK	Robotech Cobra RS Home Runner p60
Educational/Reference	POOR
Entertainment	FAIR
Productivity	EXCELLENT
Setup	POOR

Aside from relatively mundane titles like Grolier Multimedia Encyclopedia, Robotech included Aldus PhotoStyler, Aldus Gallery Effects, and HSC Software's Digital Morph. Also included was a wealth of shareware games preloaded on the hard disk—some good, some bad, none included on any of the other PCs. All can be easily uninstalled. Robotech also includes backup system disks and more-than-adequate documentation.—*WPF*

▶ Robotech Inc., *Midvale, UT; 800-255-2215, 801-565-0645; fax, 801-565-0680.*

Circle 471 on reader service card

The Dawning of Desktop Telephony

By Anush Yegyazarian

In the early days of the telecommunications industry, telephony used to describe what your telephone company did. Today the term has been resurrected by the computer industry and has come to mean the melding of telephone features with your desktop PC. Future systems with advanced telephony capabilities will be able to answer your calls, allow you to dial out through your PC, set up conference calls from your computer, embed phone numbers into documents, link names and numbers with records such as past sales, and much more. While today's systems can't quite perform all these tasks, they have taken the first steps.

The bare minimum needed for PC-based communications—a modem—was included in all the units we tested. With modems, many vendors also ship basic communications software that lets you send and receive faxes from your PC. Most also offer trial software subscriptions to major on-line services such as America Online and CompuServe. More advanced telephony systems like those in the AT&T Global Information Solutions and Compaq Computer Corp. units let you use your PC as a telephone, dialing out from an electronic phone book. These PCs further differentiate themselves by the customized software front ends they include.

AT&T goes yet another step further with its Globalyst. It features full-duplex speakers, so if you and your caller speak at the same time, you can hear each other instead of experiencing frustrating clipping effects. It can also set up different mailboxes for various people using the system, forward messages and faxes to other numbers, and program the system to fax documents to specified recipients. Caller ID is optional (if available in your area); it provides caller numbers (and names if present in your personal phone book) on any incoming call. The AT&T Globalyst's Personal Communications Center is well done, with a telephone-like interface to guide you.

Telephony features can turn your PC into a speakerphone and voice mail system—albeit an expensive one.

The Compaq Presario's Operator has the same types of functions as AT&T's system, but it's slightly friendlier. It, too, is arranged more or less like a phone, and manages to walk the fine line between being *too* helpful and not helpful enough. The Presario, however, lacks the full duplexing and Caller ID of AT&T's system.

Packard Bell Electronics' 486DX2/66 Multimedia System also used its own telephony software, Call Center. It looks like an answering machine that logs both fax and voice mail messages. This unit offers the same features as the Presario, except for full fax forwarding, and lacks a speakerphone, so a handset must be used when dialing out. The sound quality of its answering machine is not as good as that of other units, however.

Other systems with packages not quite as sophisticated are still noteworthy. Acer America Corp. and Tagram System Corp. used Pacific Image Communications' SuperVoice package in their PCs. It has an excellent help feature, is easy to use and provides the same functionality as Packard Bell's system, except that you cannot use it to make a phone call. The IBM Aptiva 530 PC Model 530 stands out due to its voice-recognition capabilities. The IBM Aptiva 530 can be "trained" to recognize basic voice commands, and retains a list of words that it "knows." Don't assume this capability will turn your PC into a voice typewriter, though.

Although the telephony features found in today's PCs are useful, they are still not ready to replace your telephone. One limiting factor today is ease of use: even a phone with a built-in answering machine and voice mail is easier to use than a PC, and is also much cheaper. But who knows? Technology just may merge to a point where the PC does replace the telephone as a means of communication. □

Tagram System Corp.

• Tagram Platinum I

While the $2,449 Tagram Platinum I is a strong performer with quality software preinstalled, it comes up a bit short as a home multimedia PC. New users may be

put off by the lack of a system manual and on-line help.

There was no detailed setup guide or system manual, but a brief quick-start sheet offered basic warnings (such as not starting a PC that's been left out in the cold) and a map of all PC and monitor ports. An enclosed box contained most of the component manuals, CD-ROMs, and disks (including an emergency repair disk to be used if the system refuses to boot).

This PCI-based PC comes with either a CD Reference Pack or a Fun Pack and features SuperVoice, a package for managing data, fax, and voice communications for multiple users that works with the 9,600-bps data/fax modem included in the system. The unit's monitor had integrated but tinny-sounding stereo speakers.

SUITABILITY TO TASK	Tagram Platinum I
Educational/ Reference	POOR
Entertainment	FAIR
Productivity	GOOD
Setup	FAIR

The Platinum had scores in the top third of the group on most tests.—*RSA*

▶ Tagram System Corp., *Tustin, CA; 800-824-7267, 714-258-3222; fax, 714-258-3220.*

Circle 472 on reader service card

USA Flex

• USA Flex Family Edition

The $1,995 USA Flex Family Edition offers a welcome combination of processing power and quality multimedia accessories, making it a good bet for the den or home office. The 486DX2/66-based desktop unit was an average performer on all of our benchmark tests.

The first thing you see as you open the system unit box is a system manual, a customer service folder, and a "Read This First" sheet. While the spiral-bound system manual, with its rough sketches and

illustrations, isn't the best in this roundup, it does offer enough good information to get PC novices started.

The system includes a joystick, stereo speakers, and a box full of PC accessories (including a surge protector, plastic disk box, printer cable, toolkit, copy holder, and mouse pad). After bootup, you're taken directly to Windows, where you may be surprised by a snappy retort from Groucho Marx, a wistful lamentation from Judy Garland, or another familiar quotation generated by the Microsoft SoundBits Hollywood Movies collection of sound files.

SUITABILITY TO TASK	USA Flex Family Edition
Educational/ Reference	FAIR
Entertainment	FAIR
Productivity	GOOD
Setup	POOR

Other preinstalled software includes Microsoft Money, Microsoft Works for Windows, and a large selection of Windows games. The system includes a Boca Research 14.4-kilobit-per-second fax modem and a Sound Blaster 16 sound board, but the PC's FaxWorks 3.0 software was not preinstalled.

Although the USA Flex Family Edition posted average scores overall, it produced some of the highest scores for a 486DX2/66 machine on all of our tests.—*RSA* □

▶ USA Flex, *Bloomingdale, IL; 800-872-3539, 708-351-9700; fax, 708-351-7204.*

Circle 473 on reader service card

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VOICE RECOGNITION

TALK SHOW

Voice-recognition technology for the PC lets your voice run the show.

By Wayne Rash, Jr.

IN THIS REVIEW

DragonDictate for Windows 205
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Since the late sixties, our expectations for voice-recognition technology could be characterized by the words "Open the pod bay doors, HAL." While we're still a long way from conducting an intelligent dialogue with a computer, voice recognition on the PC is finally advanced enough to change the way people and machines relate.

Voice-recognition packages for the PC have been available for about five years, but until recently, they were little more than curiosities that demanded lots of hardware. Over the last year, there has been an explosion in commercially available products that run on standard platforms without extensive additional hardware.

The simplest of today's voice-aware products let you control standard Microsoft Windows and OS/2 applications with verbal commands instead of a mouse or a keyboard. More sophisticated systems with large vocabularies can take dictation or serve as the core of your own speech-aware applications.

Illustration by Francisco Cáceres

HIGHLIGHTS

Voice-Recognition Software

VOICE-RECOGNITION SYSTEMS that are truly speaker-independent and support continuous speech still lie in the future, but they're where the market is headed. Today's products generally make you spend time training software to recognize the intricate patterns of your voice, inflection, and pronunciation. Many require discrete speech, in which you must pause between words.

STILL, THEY WORK. These products function remarkably well, potentially saving you a lot of time and making your desktop PC more comfortable to use. And voice recognition no longer requires unheard-of hardware: All the products we reviewed will run on a 486-based system with a sound card (some come with dedicated cards).

DICTATION SYSTEMS capture text as you speak. They work with word processors to create documents from your spoken input; some also support navigation functions. The best of these systems allow error correction on the fly based on context, and all demonstrate improved recognition accuracy over time as they learn your particular voice patterns and inflections.

VOICE NAVIGATORS are inexpensive software applications that require the purchase of a sound card. They put you in voice control of your Windows or OS/2 desktop and applications, supplanting the mouse and keyboard for most functions. Navigators parse spoken commands in order to maneuver through menus and windows, launch and close applications, and control cursor movement. Some products ship ready-to-handle common applications; others must be taught by rote.

DEVELOPMENT PLATFORMS, aimed at C or Microsoft Visual Basic programmers, let you build voice-enabled applications and add voice-recognition capabilities to existing applications for specific tasks. Development tools include sample code, documented APIs, and the necessary C libraries or custom controls.

THREE BASIC CATEGORIES

Voice-recognition products fall into three basic categories: navigation, dictation, and development. Of the three, navigation products are the most numerous.

Navigation software, which has been available for the PC for about two years, lets you control software operations, including launching and operating applications, by giving spoken directions. On a Windows-based computer, for example, you might use such voice control to open and close programs and program groups or to copy and move files. You need to buy a sound card to use a navigator, but some navigators come bundled with the sound cards they support, which is the case with VoiceAssist: It is bundled with the Sound Blaster 16 from Creative Labs.

Dictation products, introduced last year for the PC market, let you use your voice to create text documents, enter numbers into spreadsheets, and even conduct on-line sessions. Because dictation systems must be able to recognize so many more words than navigators, which only need to recognize menu commands, they have been slower in coming to market. In fact, the complexity of the voice recognition necessary for dictation is sufficiently great that it places significant demands on your computer. For this reason, manufacturers usually require dedicated coprocessor cards.

Development products let you create both general-purpose applications and highly specialized custom applications that incorporate voice-recognition technology. Aimed mostly at C and Microsoft Visual Basic programmers, these systems generally include basic recognition software as well as the APIs and programming language libraries required to use it.

Navigation products let you control your software by giving spoken directions.

This story looks at PC-based products for Windows and OS/2 in all three categories. While we didn't attempt to review every product currently available, we did look at a range of products that reflects the current state of the art. For a more complete listing of currently available packages, see the chart "Other Voice-Recognition Products."

MAKING SENSE OUT OF SOUND

Successful voice recognition incorporates many types of tasks. People tend to run words together when they speak, and they don't say the same words in the same way twice. But the software must break a stream of verbal input into separate words. In order to spell each word correctly, dictation systems must also understand context in order to distinguish, for example, *to* from *two* and *too*.

Because this is such a complex process, some systems require users to pause between words. This type of voice input, called *discrete speech*, makes products harder to use. Imagine. Saying. Every. Word. Separately. . .and it's clear how daunting this can be.

Understandably, the current trend in this market is toward support for *continuous speech*, in which recognition systems work the way people actually talk. Currently, continuous speech is supported by

Our Contributors: ELISABETH H. HOLZER is a staff editor at *PC Magazine*. WAYNE RASH, JR., is a Washington-based journalist who writes frequently about voice-recognition technology. THOMAS MACE was the associate editor in charge of the story, and JAY MUNRO was the project leader.

the navigation and development products we reviewed. Continuous-speech systems depend on hearing phonemes, the subcomponents of spoken words. The voice-recognition software must keep track of the phonemes and discern when they create a word. The IBM Continuous Speech Series (ICSS) understands 50 phonemes, for example.

Many products attempt to boost accuracy by predicting words that are likely to be spoken next based on the words that have come before. Words that are often used together may be grouped in collections, called *contexts*, which are kept in memory to speed up recognition. This approach makes continuous-speech recognition more feasible.

VOICE TRAINING

Most voice-recognition products today are *speaker-dependent*: They must be trained to recognize the patterns and inflections of each user's speech. This training can be time-consuming, not to mention tedious. Ideally, voice-recognition software should respond well to any speaker; today, the market is clearly moving toward this type of *speaker-independence*, although the goal is still a distant one for many products.

Training speaker-dependent systems requires speaking words or sentences until the machine learns your speech well enough to recognize your words. All the products we tested demonstrated improved accuracy after training, but the training requirement is a major hurdle to many users. At one extreme, such as the IPDS, the process can take many hours. At the other extreme, such as the IBM Continuous Speech Series, no training at all is required. Some products billed as speaker-independent actually require some training to be fully effective, and many require that users pick a gender model that reflects the differences in the sound of male and female voices.

Complete speaker-independence has been accomplished only by IBM with its development product, although the training requirements for a few of the other products we tested are minimal enough that they are nearly speaker-independent. One of the dictation products, Kurzweil Voice for Windows, requires relatively little training and is already nearly speaker-independent. Dragon Systems' DragonDictate for Windows is nearly as good, needing only about 20 minutes of training. It's a safe assumption that most training requirements will disappear in the near future.

Although HAL remains safely in the fictional world of *2001: A Space Odyssey*, the best of today's voice-recognition systems deliver impressive solutions, from simple navigation to dictation to full-blown application development. If you don't need voice recognition immediately, it may be better to wait; the market is changing and maturing rapidly. But if you're ready to evaluate the current state of voice-recognition technology, the reviews that follow will help steer you in the right direction.

PC MAGAZINE EDITORS' CHOICE

• No Editors' Choice

While voice-recognition technology for the PC has finally advanced enough to yield productive tools, we feel that it's still too early in the game to pick a clear winner in any of the three categories we examined.

The dictation products that we reviewed are generally of satisfactory quality, but the most accurate of them, the IBM Personal Dictation System, is also the most unwieldy to train and somewhat difficult to use. It requires you to dictate into a limited text editor and then transfer the text into your application. The easiest of the dictation products to use, Kurzweil Voice for Windows, Release 1.0, is burdened by limited navigational capabilities and comes with a larger-than-standard proprietary sound card that may present installation problems.

Among the navigators, Verbex's Listen for Windows, Version 2.0, offers the strongest feature set—but it may soon be eclipsed by IBM's as-yet-unreleased navigator.

The two application development systems we reviewed, the software-only IBM Continuous Speech Series, which supports C, and Speech Systems' Phonetic Engine 500 Speech Recognition System, which supports both C and Microsoft Visual Basic, offer considerable strengths and should both be evaluated by any serious developer.

Be prepared to spend some time learning to use these products and getting them ready to run smoothly. Once you do these things, though, you'll find your PC more convenient than ever.

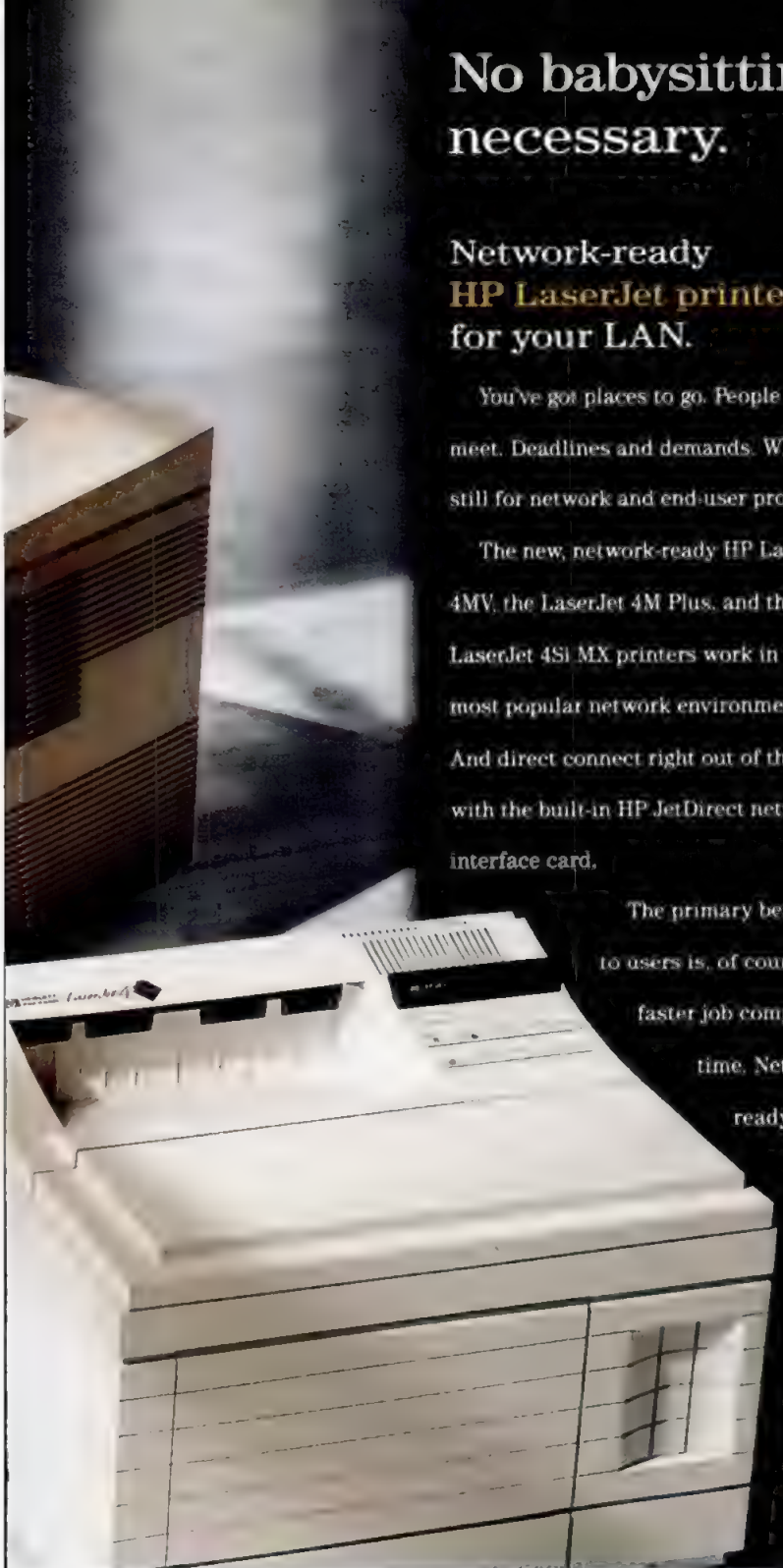
Dragon Systems Inc.

• DragonDictate for Windows

Though DragonDictate for Windows, Classic Edition, Version 1.0, has many features in common with other dictation systems, it also has a noticeable edge on the competition in some areas. For example, DragonDictate—like the IBM Personal Dictation System (IPDS) and Kurzweil Voice for Windows—is speaker-dependent and requires the use of discrete speech. But unlike the other products, it lets you use any sound card and almost any headset. This means that Dragon Systems is opening the dictation market to significantly more users.

DragonDictate combines a dictation system that will work in any Microsoft Windows application with a competent Windows navigator. While the navigator does have some inherent limitations—you can launch an application using DragonDictate only if you have placed that program's icon in the Dragon program group, for example—it allows flexible voice control of most applications within Windows. DragonDictate allows you to dictate text directly into many popular Windows word processors, a feature it shares with Kurzweil Voice for Windows but not with IPDS. The latter requires you to dictate first into a special

*HP JetAdmin and similar utilities are available for NetWare, UNIX, Mac, LAN Server, LAN Manager and other popular networks. **In Canada, call 1-800-387-3867, Ext. 8549. Adobe, PostScript, and the PostScript logo



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Performance Tests: Voice-Recognition Software

The three dictation products we evaluated yielded excellent results, although the training required varied widely. The five navigators displayed a wide range of functions, and all but one became more accurate with training. Both development systems offered considerable power.

How We Tested

To test voice-recognition capabilities, we installed each product according to the manufacturer's directions. This included using proprietary sound cards and headsets. For products that promised to work with standard sound cards—all the navigators and DragonDictate for Windows, Classic Edition, Version 1.0—we used a Creative Labs Sound Blaster 16. We tested each product with the generic headset supplied with the Sound Blaster and then with a Conneaut Audio Devices CAD-89, a high-quality unidirectional dynamic headset. Our standard test system was a Pentium-based Gateway 2000 P5-60 with 16MB of RAM and a 540MB IDE hard disk. All tests were conducted using DOS 6.2 and either Microsoft Windows for Workgroups 3.11 or IBM OS/2 2.1.

DICTATION

To rate the performance of the dictation systems, we composed a 190-word business letter specifically written to be difficult for voice-recognition systems to handle. We used words that needed to be capitalized, homophones, and unusual words such as *Ziff-Davis* that each system had to be trained to recognize. We dictated the letter three times to each product to determine whether the level of recognition accuracy improved with use, as all the vendors claim. Where possible, we dictated directly into Microsoft Word for Windows 6.0. We recorded the number of recognition errors in each attempt and whether the recognition failures were minor (such as dropping a capital to lowercase) or major (misrecognition or total lack of comprehension). Since dictation products also handle some navigation tasks, we tested them for these functions as well.

Overall, we found that all three dictation products were capable of achieving excellent results: The biggest differentiator was the amount of training necessary to achieve a level of accuracy that precludes extensive editing of dictated text. The best performer was DragonDictate.

NAVIGATION

To test the navigation products, we performed the required training and noted its duration. We then tested basic navigation using the mini-applications supplied with Windows and OS/2 (such as Windows' Calculator and Notepad). We tested Windows products using applications from Microsoft Office, Version 4.2. Finally, we attempted to add the vocabulary necessary to support a new application (we used Paint Shop Pro from JASC). We recorded any incompatibilities, recognition errors, and limitations. Improvements achieved through training—whether or not the product required training—were noted.

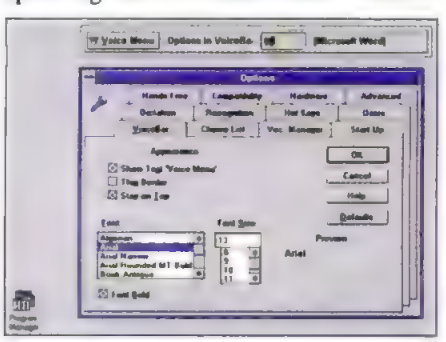
The navigators, in general, showed uneven capabilities: Two were good, but the others were hard to use or lacking in capability. Though currently in beta testing (and thus unavailable), the IBM navigator (covered in the sidebar "Navigation in a Mouseless World") was the clear leader among the voice navigators in both ease of use and capability, followed closely by Listen for Windows.

APPLICATIONS DEVELOPMENT

We tested the development products by performing basic functionality tests and attempting to use the included applications created using the demo code. We also examined sample program code to determine the level of difficulty of adding voice-recognition capability to an application. We found that both the Phonetic Engine 500 Speech Recognition System and the IBM Continuous Speech Series offer considerable development strengths.

text editor and then transfer the text to a word processor if you want to do anything more than the most rudimentary editing.

DragonDictate requires training for each user. The training process requires speaking about 750 individual words as prompted, a process that takes about 20 minutes. Once this is done, recognition is quite accurate. On our test letter, for example, the first reading produced only ten recognition errors; the second reading produced only three errors. The DragonDictate speech and grammar models were flexible enough to sense when ordinary words were used as part of a name and to capitalize accordingly. The program was also able to learn new words on the first attempt.



DragonDictate lets you change the appearance of the list of available commands and control whether or not it always appears.

Dragon Systems claims that its product will work best with an IBM Audio Capture and Playback Adapter (ACPA) and a Shure SM-10 headset. Though we had excellent results when we used these components, we found no differences in either the speed of operation or the level of recognition accuracy when we used a Sound Blaster 16 card and its included

▶ FACT FILE

DragonDictate for Windows, Classic Edition, Version 1.0

List price: $695. **Requires:** 486-based PC or better, 16-bit sound card, microphone, 9MB RAM, 20MB hard disk space, Microsoft Windows 3.1 or later. **In short:** DragonDictate is a speaker-dependent dictation system that requires discrete speech. Required training is minimal. Unlike IPDS, DragonDictate lets you speak directly into a variety of applications. DragonDictate is the state of the art if you already own a sound card, but remember that its lower price does not include a sound card or headset.

Dragon Systems Inc., 320 Nevada St., Newton, MA 02160; 800-825-5897; 617-965-5200; fax, 617-527-0372.

444 on reader service card

Other Voice-Recognition Products

Voice-recognition products can be expensive and powerful or cheap with limited functionality, but they all give your PC the ability to hear and understand you. Whether you're a developer or a dilettante, however, voice-recognition technology has a long way to go before we would recommend—as one vendor does—that you throw your keyboard away.

Product	Company	List price	Requirements*	In short
Development				
Angoss Voice Application System	Angoss Software International Ltd., 430 King St. West, #201, Toronto, Ontario, Canada M5V 1J5; 416-593-1122; fax, 416-593-5077.	$3,680.00	DOS 6.*x*	Angoss's DOS product uses Dragon Systems' voice technology and promises full automation and dictation for a suite of business applications. The package includes a headset, a DSP voice-processing card, and programmable application modules.
Custom Voice	A&G Graphics Interface, 20 Linwood Square, Boston, MA 02119; 617-445-6975, fax, 617-427-3625.	$495.00	Headset, sound card, ICSS, Microsoft Visual C++ or Visual Basic, Windows 3.1 or later	Custom Voice combines visual programming and voice-recognition technology through a set of tools designed to work with the IBM Continuous Speech Series (ICSS) and Microsoft Visual C++ or Visual Basic
Dragon VoiceTools	Dragon Systems Inc., 320 Nevada St., Newton, MA 02160; 800-825-5897, 617-965-5200; fax, 617-527-0372	$495.00	IBM Audio Capture and Playback Adapter, C or C++ compiler, Windows 3.1 or later	This package includes a library of C functions for developing speaker-dependent or speaker-independent DOS and Windows applications using Dragon Systems' speech technology. A runtime system, which includes a microphone, is $195
HARK Recognizer and Developers Toolkit, Release 2.0	BBN HARK Systems Corp., 70 Fawcett St., Cambridge, MA 02138; 617-873-4636; fax, 617-873-2473.	$9,995.00 plus runtime fees	Headset, Unix platform (such as SunOS, HP-UX, or IRIX)	A Unix-only applications-development system for continuous-speech, speaker-independent voice recognition, the HARK Recognizer parses speech into 45 phoneme groups and compares them against entries in a 100,000-word phonetic library
Micro IntroVoice	Voice Connexion Inc., 17835 Skypark Circle, Suite C, Irvine, CA 92714; 714-261-2366, fax, 714-261-8563.	$1,495.00	C or C++ compiler, DOS 2.*x* or later	This hardware device connects to a PC via an RS-232 serial port and offers a headset. It can recognize up to 1,000 words or phrases and includes a text-to-speech feature. C libraries allow integration into DOS and Windows applications
Multi-Voice with Voice Recognition Module, Version 3.0	ITI Logicel, 4263 Christophe-Colomb, Montreal, Quebec, Canada H2J 3G2, 514-597-1692, fax, 514-526-2362.	$799.00	Headset, Dialogic VR/40 sound card, C or C++ compiler, DOS 3.1 or later	ITI's package has a set of high-level C libraries to develop DOS applications for Dialogic's voice-recognition board. Functions include playing and recording voice files, playing date/time, numbers, and spell strings, and recognizing Touch-tone signals and voice.
SpeechEasy Programming Library, Version 2.0	Telaccount Inc., 257 Robinson Ave., Bronx, NY 10465; 718-824-3493; fax, 718-823-0962.	$995.00	Headset, voice-processing card, C or C++ compiler	SpeechEasy Programming Library offers a set of C and Windows DLL functions that add speaker-independent voice recognition to an application. A Vocabulary Construction Kit ($200) enables a user-customized vocabulary of 16 words
Speech Recognition Software Development Kit	Lernout & Hauspie Speech Products, 800 W. Cummings Park, #3100, Woburn, MA 01801; 800-252-4999, 617-932-4118; fax, 617-932-9209.	$2,995.00	Headset, sound card, C or C++ compiler, Windows 3.1 or later	This toolkit includes L&H's voice-processing algorithms for speaker-independent, continuous-speech recognition and isolated word or keyword spotting.
Navigation				
Aria Listener	Prometheus Products Inc., 9524 SW Tualatin Sherwood Rd., Tualatin, OR 97062; 800-477-3473, 503-692-9600; fax, 503-691-1101	$169.00 (includes Aria 16se sound card)	Headset, Windows 3.1 or later	Aria Listener, licensed from Sierra Semiconductor Corp., comes bundled with the Aria 16se sound card to provide navigation functions via vocabularies of up to 125 words. Listener also includes an audio recording and playback feature.
IN3 PRO Voice Command for Windows	Command Corp. Inc., 3761 Venture Dr., P.O. Box 956099, Duluth, GA 30136-5598; 404-813-8030; fax, 404-813-0113.	$179.00	Headset, sound card, Windows 3.1 or later	IN3 PRO Voice Command for Windows features hardware-independent, continuous-speech recognition for navigation in Windows applications
OfficeTalk for WordPerfect	Kolvox Communications Inc., 4100 Yonge St., #607, North York, Ontario, Canada M2P 2B5; 800-556-5869, 416-221-2400, fax, 416-218-3100.	$1,395.00	Sound card or IBM Audio Capture and Playback Adapter, WordPerfect 5.1 or later for DOS or Windows	This package recognizes more than 500 voice commands for creating and editing documents in WordPerfect and includes a headset. LawTalk adds a 30,000-word dictionary that allows OfficeTalk for WordPerfect to be used for dictation.
Rover for Windows, Version 1.01	Digital Soup Inc., P.O. Box 1340, Brattleboro, VT 05302, 800-793-7356, 802-254-7356; fax, 802-254-6812	$129.00	Headset, sound card, Windows 3.1 or later	Rover for Windows allows creation of voice macros for navigation through Windows applications with up to 128 keystrokes per macro. It includes a starter vocabulary of 50 words.
Telaccount Speech Recognizer for Windows, Version 3.0	Telaccount Inc., 257 Robinson Ave., Bronx, NY 10465; 718-824-3493, fax, 718-823-0962	$79.00	Headset, sound card, Windows 3.1 or later	Telaccount Speech Recognizer acts as a navigator in Windows applications with a 400-word vocabulary that can be customized by the user.
Voice Verification				
Veritel Voice System	Veritel Corp. of America, 350 W. Kensington, #117, Mount Prospect, IL 60056; 708-670-1780; fax, 708-670-1785.	$7,400.00	DOS 5.*x* or later	This PC-based security system for voice mail and LANs uses biometric voice analysis to identify users. The system can be configured with passwords and other traditional security devices in addition to voice verification
VoiceLock	QVoice Inc., P.O. Box 645, Andover, NJ 07821; 201-786-6878, fax, 201-786-5868.	$79.95	Headset, sound card, Windows 3.*x*	This low-end voice-verification product analyzes voice to authorize access rights to sensitive data files. It encrypts specified files with the user's voice as the key and works with Windows screen savers to prevent unauthorized access

* Each product requires a 486-based PC or better.

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Navigation in a Mouseless World

By Wayne Rash, Jr.

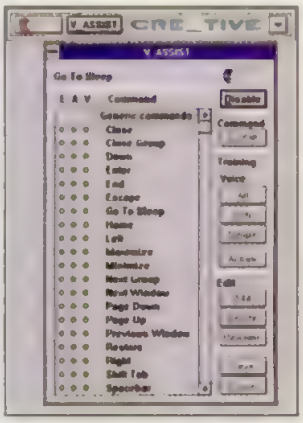
Despite the reputation that voice-recognition software has for being expensive, hard to implement, and resource-hungry, the fact is that it doesn't need to be. Inexpensive, easy-to-use programs known as *voice navigators* let you control Microsoft Windows and OS/2 menus and applications with your voice. They replace mouse movements and keystrokes with spoken commands, letting you switch between applications, for example, by saying, "Switch to Microsoft Word," rather than by performing a series of keystrokes or mouse clicks. And unlike the dictation systems, all the navigators we saw support continuous speech. Most will run on a 486-based PC with 4MB of RAM, but you will need to purchase a sound card.

We looked at five voice navigators: Listen for Windows, Version 2.0, from Verbex Voice Systems (reviewed as part of our feature story); QwickSwitch for OS/2 from BitWare Consulting; VoiceAssist, from Voice Processing Corp.; VoiceMouse from Interactive Products; and a prerelease version of IBM's upcoming but still unnamed and unpriced navigator.

Voice navigators vary with respect to the number and level of available commands they offer, but the biggest difference lies in the amount of training required to achieve optimal voice recognition. While only two of the five navigators we looked at require training, all are more accurate with training (with the exception of QwickSwitch, which cannot be trained). While the training process is not arduous, it is tedious: You dictate a series of commands as prompted, which can take up to an hour.

None of the products recognized every command that was spoken, although the IBM navigator had only occasional lapses, while VoiceAssist and VoiceMouse had failure rates of about 10 percent.

For most Windows users, the transition to voice commands will be easy, but some actions require awkward maneuvering. Launching an application from an icon, for example, can require a series of "move left," "move down," or similar directional commands to simulate mouse movement.



VoiceAssist supplies a list of generic commands.

VoiceAssist (bundled with the Sound Blaster 16; Creative Labs, 800-998-1000, 408-428-6600) offers a good way to become familiar with voice recognition, considering that it's free. But we don't suggest you buy a Sound Blaster card just to get this software.

VoiceAssist, developed by Voice Processing Corp., attempts to overcome the need to retrain the navigator to deal with common commands for each application by supplying a set of generic commands that are supposed to work with all Windows programs. While this set works well on the Windows desktop, we found that as new programs were added, retraining was necessary for many of the commands.

Training consists of dictating each command as it is prompted from a dialog box. Installation is automatic when the Sound Blaster driver is loaded. The program delivered a general protection fault when we tried to train it to use JASC's Paint Shop Pro, however.

Overall, we found VoiceAssist easier to use than VoiceMouse, but it doesn't offer the shortcuts of IBM's navigator.

VoiceMouse ($79.95; Interactive Products, 503-341-4964) is well named: It essentially replaces mouse movements with spoken commands. This sounds attractive, but we found that VoiceMouse offers somewhat less power and flexibility than similarly priced competitors.

VoiceMouse has several limitations. You must launch programs from within Windows' Program Manager, and on some menus (such as the list of recently used documents in Word for Windows) you must use movement commands such as "up" and "down" before you

standard headset. According to the company, platforms with slower processors and less memory than our test system should show a greater difference in speed and performance. Accordingly, users with standard 486-based machines should consider the ACPA card.

DragonDictate shows the current word being recognized in a recognition box in the dictation window. You can signal a mistake by saying "oops," which brings up a correction screen that shows in a numbered list the previous five words you dictated. You select the word that was recognized incorrectly by speaking the number that corresponds to that word. A second list will appear, showing a selection of suggested corrections. You can either choose the correct replacement or simply type in a correction manually. This system makes entry and correction both fast and easy.

DragonDictate controls Windows applications in much the same way as the navigation tools we review. The most noticeable difference is that DragonDictate requires discrete speech, so you must separate command strings into individual words when you dictate them. Dragon Systems delivers the product with the required information to run most popular applications, and you can train it to recognize new commands.

can initiate an action.

Training VoiceMouse takes slightly longer than training VoiceAssist because it requires you to speak each command twice. This process should result in better recognition since the software has more opportunity to sample the user's voice. Unfortunately, it doesn't.

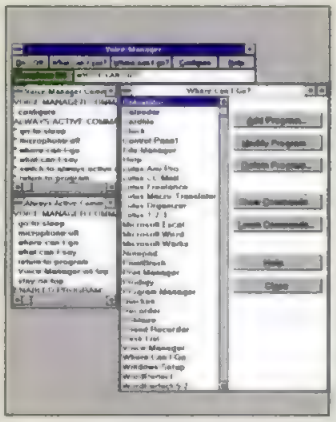
VoiceMouse also gave us some installation headaches. The installation program forces you to enter a 19-digit case-sensitive serial number, and it delivered a general protection fault the first time we tried to check the program settings. Launching the training routine is harder than it should be because the steps described in the manual are in incorrect order.

We got a sneak preview of **IBM's navigation product** (name not finalized, pricing not available; IBM Corp., 800-825-5263). Even in prerelease form, this Windows product is clearly the easiest to use of the five we saw. It is the only speaker-independent navigator besides Listen for Windows; the software is based on the Windows version of the IBM Continuous Speech Series (ICSS) development platform.

While the program does require you to train it to recognize commands that aren't on its list of generic commands, the process doesn't need to be repeated for each user. Any user can create the voice file, and the file can be used by anyone else.

This means that during the time you would be training VoiceAssist and VoiceMouse, you would already be using IBM's product unless you're the program's sole user. Launching a program is as simple as saying "Switch to..." followed by the name of the application and can be done from within another application. If the program is already open in the background, it becomes the active application.

IBM hasn't announced whether the product will be available as a standalone or will be bundled with other hardware or software. The ship date is also undetermined.



IBM's navigator, now in beta, was the easiest of the bunch.

QwickSwitch for OS/2 ($49; BitWare Consulting, 800-776-8284, 604-435-0627), an OS/2-based navigator for Presentation Manager, is an add-on for the OS/2 version of ICSS.

The program doesn't require training, but it offers a limited number of commands and doesn't let you add additional ones. QwickSwitch was originally designed to offer hotkeys: The speech interface is an added function. Its voice-recognition capability is delivered by ICSS. It does provide a simple way to launch and toggle between programs, but unless you're already using ICSS on OS/2, you can find more flexibility and power elsewhere. □

Dragon Systems has priced this offering at the low end of the range for dictation products, but remember that the product requires the purchase of a sound card (typically $200) and a headset, which the others do not—bringing its price in line with the competition. A starter version with a 5,000-word dictionary costs only $395, which is less than half the price of competing products. The version we reviewed—the Classic Edition, with a 30,000-word dictionary—sells for $695, which is still well below the competition.

Overall, Dragon Systems has delivered a state-of-the-art product in DragonDictate. While all of the dictation products we review offer similar functionality, DragonDictate for Windows tops the list with outstanding performance at a reasonable price.—*Wayne Rash, Jr.*

IBM Corp.

• IBM Personal Dictation System
• IBM Continuous Speech Series

IBM is moving in two directions with its voice-recognition products. The IBM Personal Dictation System (IPDS) is an OS/2-based, speaker-dependent product that requires discrete speech and comes with a dedicated voice-processor card. The IBM Continuous Speech Series (ICSS), a development platform created by a different IBM group, is speaker-independent and works with standard sound cards. Because it's speaker-independent, ICSS requires no training; training time for IPDS can stretch into days. IPDS delivers excellent dictation accuracy, and ICSS will be highly attractive to C or Microsoft Visual Basic developers.

IBM PERSONAL DICTATION SYSTEM

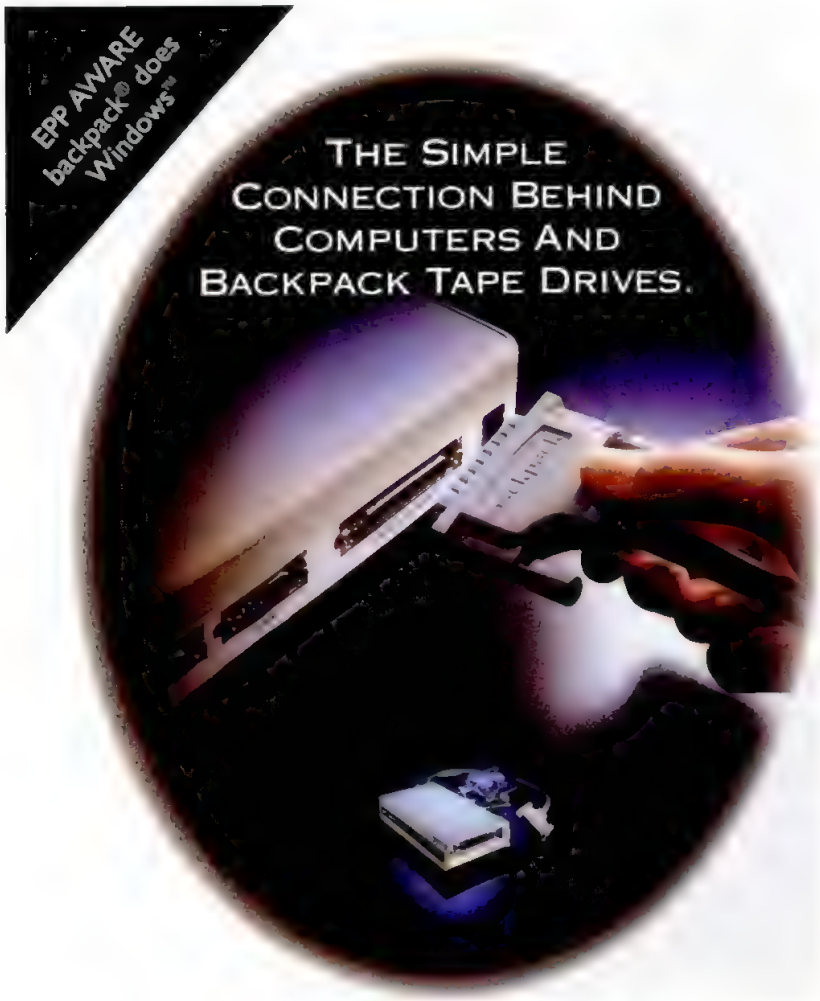
According to IBM, IPDS was designed for applications that need a high level of accuracy. And we found that it is, in fact, highly accurate. But because the training required is extensive, IPDS is much more difficult to get running than any other product we looked at. It is also far less intuitive than any of the others.

Training IPDS is the first step; this needs to be done by each new user. Once you load the software and install the board, you dictate two essays: a short story by Mark Twain and a description of voice-recognition technology. This part of the process takes an hour and a half or more. IPDS then builds databases, which requires another 2 hours or so of intensive disk activity, or as much as 10 to 12 hours on machines with disk compression.

Unlike DragonDictate, which lets you dictate into a third-party word processor, IPDS displays dictated text in a dedicated text editor that's included with the product. The initial editing helps IPDS learn each speaker's voice characteristics. The IPDS text editor can't handle much beyond creating text and correcting recognition errors, however. Your text must be moved to a word processor for even such simple formatting tasks as inserting tab fields and moving blocks. IPDS includes

an OS/2 Presentation Manager navigator that effectively launches and controls OS/2 applications, although we did have a problem using an application in WIN-OS/2 that caused the computer to freeze.

Despite the installation and training hurdles and the limited text editor, IPDS's voice-recognition abilities are strong. Our tests revealed that the IPDS language and context models are quite flexible and the 24,000-word vocabulary is adequate. As the software monitors the dictation process, you can see it follow your words, making a best guess about each. As you continue, IPDS may revise a previous word based on new context. The result is a high level of accuracy. When we dictated our test letter, IPDS missed only three words on its initial attempt, a score far better than those of the competition.



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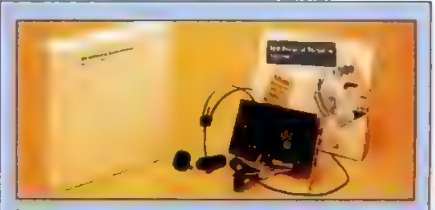
IBM CONTINUOUS SPEECH SERIES

The IBM Continuous Speech Series is a development platform that provides tools for creating voice-based applications and lets you voice-enable Windows and OS/2 applications. It doesn't require training and doesn't demand discrete speech.

ICSS is available for Windows and OS/2 platforms. Both versions are essentially identical, though IBM plans to add improvements to the Windows version, such as the ability to add words to the product's vocabulary by speaking them only once. This closely resembles a similar capability in IBM's unreleased navigator, a prerelease version of which we tested.

ICSS ships with a 25,000-word dictionary. The words that ICSS can recognize are subdivided into *contexts*, each containing about 1,000 words. Contexts are collections of related words that ICSS assumes will be spoken together. ICSS can keep several contexts in memory at the same time and switch among contexts as required.



FACT FILE

IBM Personal Dictation System

List price: ISA version, $998, Micro Channel version, $1,078 **Requires:** 486-based PC or better, sound card (included), microphone (included), 16MB RAM, 62MB hard disk space, OS/2 2.1 or OS/2 for Windows. **In short:** IPDS is an OS/2-based, speaker-dependent product that requires discrete speech. Its accuracy was superior, but you can't dictate directly into your applications, and training can take days. IPDS was the most difficult dictation product to get up and running—and the most difficult to use

IBM Continuous Speech Series

List price: $399; runtime version, $249 **Requires:** 486-based PC or better, C/C++ or other compiler, OS/2 2.1 or Microsoft Windows 3.1 or later **In short:** The IBM Continuous Speech Series is a speaker-independent development platform that supports continuous speech, works with standard sound cards, and doesn't require training. It includes C-language routines and APIs for developing powerful and flexible voice applications. Its modest price tag and support for continuous speech mean it will play a large role in the market's future.

IBM Corp., P.O. Box 100, Somers, NY 10589, 800-825-5263, 914-765-1900, fax, 914-766-2788

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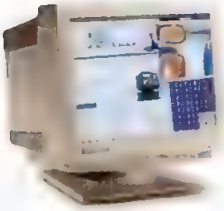

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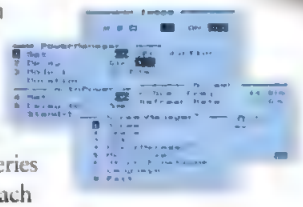

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VB Power

ISBN: 1-56276-073-4
Price: $34.95

This innovative guide by Dan Appleman turns Visual Basic programmers into power users by illuminating the tools of the Windows Application Program Interface (API). Includes a time-saving disk that contains source code from the examples in the text, plus a specially designed dynamic link library (DLL).

Available at fine bookstores, or call 1-800-688-0448 ext. 8448

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You can adjust ICSS applications to recognize the speech styles of specific users or groups.

ICSS ships with a collection of C language routines for either Windows or OS/2 that use information received through a sound card to perform voice recognition. The product's voice-recognition engine can reside either on the workstation or on a network server. The division of labor between the client-based application software and the server-based voice-recognition engine gives users and developers considerable flexibility. It means that client workstation resource demands can be minimized (less than 1MB of RAM is required) and that companies can create and update standard contexts, storing the information in one place. ICSS uses TCP/IP for communications between its client and server portions.

The ICSS development tools work with C and Microsoft Visual Basic, as well as with other programming languages that will support C language libraries. ICSS includes several applications that demonstrate its capabilities, and it includes source code for those applications as a programming reference.

This product's $399 price buys you a complete voice-recognition development tool kit that can turn out powerful and flexible voice-recognition apps that avoid the productivity issues related to training and speaker-dependence. Both Windows and OS/2 developers will want to evaluate its sizable potential.—*WR*

Kurzweil Applied Intelligence Inc.

• Kurzweil Voice for Windows

Kurzweil Applied Intelligence has spearheaded much leading-edge research into voice recognition and was one of the first companies to deliver successful voice-recognition products. This may explain why Kurzweil Voice for Windows, Release 1.0, can handle dictation with very little training while maintaining good levels of accuracy. Kurzweil claims that Voice can operate at about 85 percent accuracy with no training and that accuracy will improve dramatically over time as the software learns the characteristics of each speaker. Our tests validate Kurzweil's claims—although we uncovered some incidental limitations in other parts of the software.

For example, Voice's navigational capabilities are inferior to those of both the navigators and other dictation systems. While the product can be configured so that most of its operations can be handled by voice alone, some actions (such as displaying the list of active available commands) can only be accomplished using a mouse. Other navigation commands can be performed using voice, but the process is laborious. You'll need to repeat spoken commands a number of times in order to move around the screen as though you were using the Tab or arrow keys.

Unlike DragonDictate but like IPDS, Voice requires a dedicated sound board. The product comes with a proprietary full-length card that might not fit easily into all computer systems. To install it in our Gateway test system, we had to shuffle cards around. The product also comes with a Shure VR-230 headset that works well for voice recognition.

ON-THE-JOB TRAINING

Voice's dictation functions work much better than its Microsoft Windows navigation functions. The product is ready to run once you install the software and sound card and specify the speaker's gender. With continued use, it learns to recognize each user's voice more accurately,

The more you use Kurzweil Voice for Windows, the better it will recognize your speech.

taking its cues from the corrections made during each dictation session.

By the second time we dictated our test letter, we had only 10 recognition errors—down from the 23 errors on the initial try. The product worked quickly and took dictation from within applications. This eliminates a step required by IBM's dictation system (IPDS), in which text must be dictated from within a dedicated yet very limited text editor and then transferred into an application after dictation is complete.

Windows that you can either hide or display atop your active application window show the current word being recognized, a list of the possible alternatives to the current word, and a list of recently recognized words, letting you make corrections on the fly. These lists make creating text easy. By supporting specific editing commands such as "back up three," these lists allow users to change their minds easily and to correct recognition problems simply. Users have the choice of installing the product with support for either 30,000 words (the module we tested) or 60,000 words. The latter module yields higher levels of recognition, but at the expense of system resources and disk space.

While Kurzweil's voice recognition works well, especially considering the minimal investment in training time required, its large dedicated sound board and limited navigational capabilities make it slightly unwieldy.—*WR*

FACT FILE

Kurzweil Voice for Windows, Release 1.0

List price: $995 **Requires:** 486-based PC or better, sound board (included), microphone (included), 8MB RAM, 30MB hard disk space, Microsoft Windows 3.1 or later **In short:** Kurzweil Voice for Windows is a speaker-independent dictation system that requires discrete speech and very little training. Its highly accurate voice recognition, however, is somewhat offset by its inferior navigational capabilities and full-length dedicated sound card that may be difficult to fit into a crowded system.

Kurzweil Applied Intelligence Inc., 411 Waverly Oaks Rd., Waltham, MA 02154; 800-380-1234, 617-893-5151; fax, 617-893-6525

446 on reader service card

Verbex Voice Systems Inc.

• Listen for Windows

Verbex Voice Systems, following what has become a clear trend in voice-recognition software, has released Listen for Windows, Version 2.0—a speaker-independent version of its popular Listen for Windows voice navigator. In theory, speaker independence obviates the need to train the program to recognize particular speakers, but as with other voice navigators, Listen's level of accuracy increases significantly with training. We found that while the software will work immediately after installation, about a third of all valid commands were missed (either ignored entirely or misinterpreted) without training. With training, however, Listen reaches near-perfect accuracy.

Unlike most of the Microsoft Windows navigators, Listen specifically supports

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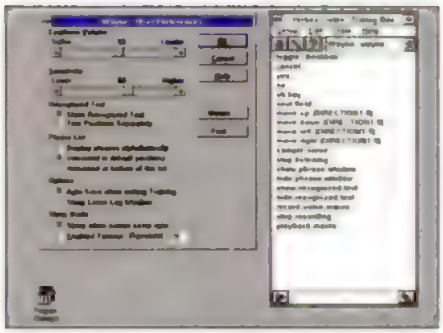

You can customize the Listen interface to display or hide the list of words or phrases that can be used with the active application.

many popular Windows applications right out of the box, including AutoCAD, Lotus SmartSuite, Microsoft Office, and Quicken. Other navigators require you to train them to recognize the menu commands used in the application you want to run. The Listen Command Editor can voice-enable other Windows applications using a similar training process.

Using a voice-enabled application with Listen for Windows is simple. You can launch it or switch to it from within other applications without going through complicated menu steps, a feature also offered by the IBM navigator (currently in beta testing; see the sidebar "Navigation in a Mouseless World") but none of the others.

Unlike other products, Listen offers shortcuts that let you bypass some levels of nested menus: Within Microsoft Word, for example, you can change the current font size from 10 points to 12 points by saying "font size 12," rather than maneuvering your way through pull-down menus and dialog boxes.

Part of the reason Listen is easy to use is that it displays a list of available commands for the currently active application on the screen at all times, as do the other packages of this type. When you switch to a new application, Listen displays the corresponding list of available commands. Once you've learned them, you can eliminate the prompt box.

Listen uses two gender-specific speech models. Before training, the software recognized male voices more consistently than female voices; after training, it recognized them equally well. Verbex claims that the software understands most North American voices and can be tuned to the specific voice characteristics of individual users. But speakers with strong accents or who speak in a dialect will have to spend time training the product.

Listen helps reduce recognition errors by sampling background noise (which constantly fluctuates) as needed to adjust the voice volume level; it also allows correction of recognition errors on the fly.

Like other navigators, Listen requires at least a 33-MHz 486SX PC host with Windows and a Sound Blaster-compatible sound card. Alternatively, the program will run on a 386SX with Verbex's digital signal processing card.

Listen isn't the ultimate navigator—IBM's beta product seems to require less training for optimal performance. But Listen is worth a close look: It's very reliable after training and available today.—*WR*

▶ FACT FILE

Listen for Windows, Version 2.0

List price: $139 **Requires:** 486-based PC or better, 16-bit sound card, microphone (included), 4MB RAM, 10MB hard disk space, Microsoft Windows 3.1 or later **In short:** Listen for Windows is the most expensive navigator we saw, but it includes a headset, specifically supports many popular Windows applications right out of the box, and lets you take shortcuts through nested menus. Its speaker-independence should obviate the need for training, but we found training was necessary in order to avoid gross errors

Verbex Voice Systems Inc., 1090 King Georges Post Rd., Bldg. 107, Edison, NJ 08837, 800-275-8729, 908-225-5225, fax, 908-225-7764

447 on reader service card

Speech Systems Inc.

• Phonetic Engine 500 Speech Recognition System

Speech Systems designed its Phonetic Engine 500 software development kit for developers creating voice-aware programs for highly specific applications. Like the IBM Continuous Speech Series (ICSS) development platform, the PE500 lets you create applications that do not require training and do not demand discrete speech. While the PE500 is more than twice the price of the software-only ICSS, it comes with a sound card and noise-canceling headset. Overall, it offers a powerful tool for creating voice-aware applications in C, C++, and Microsoft Visual Basic; and supports any Microsoft Windows application that can call DLL functions, including database systems such as Microsoft Access, Versions 1.1 and 2.0, and Borland International's Paradox (all Windows versions).

The product is based on a continuous-speech, speaker-independent recognition engine and a rich, well-documented API.

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The PE500 system also includes a simple development environment, a Windows DLL, a Visual Basic custom control, source code examples that demonstrate how to create a variety of voice-enabled applications for Microsoft Windows, and a module to test the flexibility and scope of the voice portion of the applications you are creating.

HOW IT WORKS

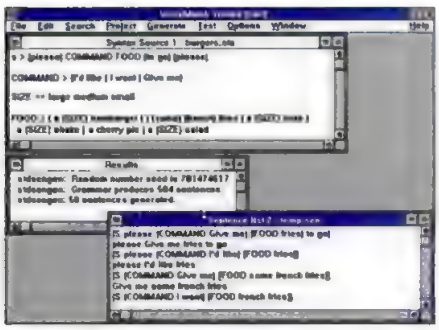
To use the PE500, you create a *syntax* for each application you want to create or speech-enable. A syntax is a set of rules defining the allowable words or strings of words at each point the underlying application expects voice input. In effect, it's a script that uses variables to represent groups of words or strings.

To enable a user to query a database in Microsoft Access by voice, for example, you first use the VoiceMatch Toolkit to write a syntax based on the fields in your database. Then you use the Windows DLL to hook the syntax to your database.

Since the engine recognizes a string of words as one continuous phonetic unit, you speak naturally—without the pauses between words other systems demand. This also means that if you pause between words, the PE500 will not understand you.

The PE500 also lets you provide recorded text—in the form of a greeting, a prompt for user response, or confirmation of user input, for example—using sound files compatible with standard Windows sound boards. The version we saw will not let you record .WAV files, but company sources say this is coming soon.

The Phonetic Engine 500 comprises a voice-processing card, software, and a headset. The card sports a 24-bit Motorola digital signal processor. While its predecessor, the PE400, had an on-board Motorola 68020 CPU, the current version doesn't; it passes the processing load to the computer's CPU. Though previous versions of the Phonetic Engine included a cumbersome AKG headset, the current version includes a standard-design Gentex headset. Finished applications are distributed with the $595 runtime version.



You can use the PE500's VoiceMatch toolkit to test the flexibility of a syntax you create by generating all allowable input.

▶ FACT FILE

Phonetic Engine 500 Speech Recognition System

List price: $995; runtime version, $595 **Requires:** 386-based PC or better, sound card (included), microphone (included), 8MB RAM, 20MB hard disk space, Microsoft Windows 3.0 or later **In short:** The PE500 is a speaker-independent development kit that includes a rich API, source code, sample applications, and a modest development environment. About twice the price of the software-only ICSS, it includes a sound card and headset and supports Visual Basic as well as C. Its recognition was somewhat less accurate than ICSS's, however.

Speech Systems Inc., 2945 Center Green Court South, Boulder, CO 80301; 303-938-1110.

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We tested the first release of the new PE500. By the time you read this, the PE500 will also be able to record and play back .WAV files. A SpeechWizard program, which will allow nonprogrammers to add voice-recognition capabilities to Windows applications, is also slated for inclusion in the upcoming release. The SpeechWizard is a small background application that lets you build a macro that adds voice-recognition functions through OLE 2.0 automation or keystroke recording.

The $995 Phonetic Engine 500 offers many of the same capabilities and features as its competitor, the $399 ICSS. But its ability to use familiar tools such as Visual Basic or PC databases is a decided plus. It also includes all required hardware (ICSS is a software-only product). In fairness, the price difference between the two should be insignificant in the context of a software development program. If you are looking to develop voice-aware applications, this tool deserves your serious consideration.—*Elisabeth H. Holzer* □

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–PC Computing, November 1993

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– Personal Computer Magazine (UK) January 1994

"True to the company's word, we found Cyrix's DRx² an easy upgrade that can deliver a performance boost (to your) wheezy old 386."

–Computer Shopper, February 1994

"... ... ..."

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PC Magazine, February 8, 1994

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–Computer Shopper, February 1994

"Cyrix's clever design makes it possible to upgrade nearly any 386 in existence, without hassle or high cost...All you need is a fast, affordable upgrade for an office of 386s. The Cyrix Cx486SRx² is it. Just plug it into your s386 system and go."

–PC Computing, December 1993

"Cyrix has developed inexpensive upgrade chips for 386-class personal computers...and the effect will be like dropping a Corvette engine into a Ford Escort...We decided to try one of the Cyrix chips. The result was impressive...Think about how much a small company could save."

– Barry Cooper, The Orlando Sentinel, February 10, 1994

"...dropping in a Cyrix Cx486DRx² Upgrade Microprocessor is a quick way to really push performance."

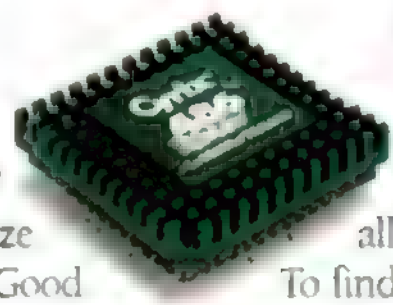
– WordPerfect the Magazine, December 1993

"Cyrix's solution is simple. You remove the existing 386 chip from its socket, plug in the Cx486DRx² and run some software."

– PC Magazine, October 13, 1993

"...Cyrix gives new life to older 386SX- and 386DX-based computers...This may be the best upgrade solution we've seen yet for users of older machines who don't want to shell out $1,500 or more to move into a new 486-based system."

– Windows Magazine, The Win 100 The Best Windows Products of the Year February 1994



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OS/2 WARP, VERSION 3, AND WINDOWS NT WORKSTATION, VERSION 3.5

You can wait for Windows 95 to ship, or you can explore the innovative features and enhancements of IBM's and Microsoft's state-of-the-art 32-bit operating systems.

The Future's Here Today

By Rick Ayre and Amarendra Singh

Are you ready for a brand-new operating system that delivers 32-bit performance, true multitasking, and a level of stability that keeps your data safe from poorly behaved applications? Do you want it to look like the kind of environment you're used to, only better? If you think you have to wait for Microsoft Windows 95, think again. There are not one but two new 32-bit operating systems you can actually buy today—IBM's OS/2 Warp, Version 3, and Microsoft Windows NT Workstation, Version 3.5—and both offer features and innovations that Windows 95 won't match, no matter when it finally ships.

IN THIS REVIEW

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WHAT'S NEW

Though IBM and Microsoft make different promises about what their new 32-bit operating systems deliver, they both assert that all the features they decided to include in the new versions are based on user feedback.

OS/2 Warp is easier to install, easier to use, and more full-featured than previous versions. The bundled software in its BonusPak makes it a better value than previous versions of OS/2. Windows NT 3.5 is smaller and faster than before, has an increasing number of applications designed specifically for it, supports Win16 applications better, comes with improved NetWare connectivity, has better In-

Photography by Stuart Herr

ternet access, and supports the OpenGL standard.

Similar though they are in some ways, these two desktop operating systems aren't really positioning themselves against each other. Rather, each will be going up against Windows 95, which you'll be able to buy sometime in the first half of 1995.

PC MAGAZINE EDITORS' CHOICE

• Tough choices in 1995

What operating system will you be using on your desktop one year from now? For many, the answer is simple: It will be the same one you use today, Microsoft Windows 3.1. Though Microsoft is virtually guaranteed to sell millions of Windows 95 upgrades as soon as they become available, Windows 95's ship date remains uncertain; so IBM has a chance to market OS/2 Warp, Version 3, and power users have a chance to evaluate the advantages of Windows NT Workstation, Version 3.5.

You should move to OS/2 Warp, Version 3, if you're already an OS/2 user; if you're attracted by its object-oriented drag-and-drop interface; if you want to get crash protection without a huge memory upgrade; or if you're interested in its excellent communications tools and easy Internet access. Unlike Windows 95 or Windows NT, OS/2 Warp will work in 4MB RAM, though not well. And be

WARP FACTOR

Depending on how you count, there are either two, four, or five members in the OS/2 Warp family. OS/2 Warp, Version 3, comes in two basic configurations: one for the standalone user ($129), and the other, OS/2 Warp LAN Client, Version 3, for the LAN-connected user. Both the standalone and LAN Client versions come in configurations that either install over your current DOS and Windows or include IBM's WIN-OS/2 if you don't currently have Windows. In addition, there's a version that supports symmetric multiprocessing.

The only OS/2 Warp version shipping as we went to press was OS/2 Warp, Version 3, the version without WIN-OS/2. Both WIN-OS/2 support and the OS/2 Warp LAN Client are expected to ship by the end of 1994.

The extended Warp family includes OS/2 LAN Server 4.0 (up to 80 clients), and LAN Server Advanced (more than 80 clients).

Choosing the right version is easy. If you want just a desktop OS and you already have Windows, choose the basic configuration. If you need Windows too, buy the flavor that has WIN-OS/2. If you need network client support, choose OS/2 Warp LAN Client, which adds the LAN server requester, NetWare client software, and enhanced TCP/IP applications, as well as LAN Distance for remote connection to your LAN and System Performance Monitor/2.

THE WINDOWS FAMILY

The Windows family has also grown. Today, there is Windows 3.11, Windows for Workgroups 3.11, and the new $279 Windows NT Workstation, Version 3.5. Like Windows for Workgroups, Windows NT 3.5 comes with network client software and peer-to-peer networking, but it adds security and crash protection in a full 32-bit multitasking, multithreaded environment. The extended Windows family includes Windows NT Server, Version 3.5, a high-end server operating system (formerly known as Advanced Server).

Choosing the right version of Windows has gotten more challenging. Should you buy Windows NT 3.5 for your

HIGHLIGHTS

OS/2 Warp and Microsoft Windows NT Workstation

THERE'S NO NEED TO WAIT for Microsoft Windows 95 if you want to get a high-powered 32-bit operating system. Both IBM OS/2 Warp, Version 3, and Microsoft Windows NT Workstation, Version 3.5, are available now, and both offer features that Windows 95 won't.

OS/2 WARP'S INTERFACE is object-oriented and relatively easy to learn. The OS features a bundle of 32-bit apps in its BonusPak, including incredibly easy communications tools and direct access to the Internet. However, you'll still face the problem of finding mainstream business applications that are specifically designed for OS/2. Fortunately, all your 16-bit DOS and Windows apps will run without problems.

THE NEW VERSION OF WINDOWS NT still looks like Windows; long-time Windows users may, in fact, be glad that it doesn't have the new Windows 95 interface. NT's powerful security, networking, remote access, and multiprocessing features demand high-end hardware. Don't even think about using it unless you have a 66-MHz 486 and 16MB RAM.

IN BENCHMARK TESTING, neither OS/2 Warp nor Windows NT 3.5 could outpace good old Windows for Workgroups when it comes to running today's typical 16-bit applications. Most of their performance advantages are seen in high-end multitprocessing and multitasking. Windows NT also has symmetric multiprocessing talents that let you use dual-processor systems to speed up calculation-intensive work.

aware that there is still a lack of OS/2-specific business applications. You may have to use OS/2 Warp's bundled productivity apps, which are useful but not state of the art. One feature you're sure to find useful: OS/2 Warp's excellent support for DOS games.

Windows NT Workstation, Version 3.5, is a very attractive alternative for Windows power users with high-end systems (at least a 66-MHz 486 with 16MB RAM). It has crash protection for 16-bit apps, full OLE support for 32-bit apps, strong multiprocessing and multitasking talents, and the familiar Windows interface rather than the Windows 95 interface; it's also optimized for processor-intensive 32-bit applications. Windows NT 3.5 also includes OpenGL, a 3-D graphics programming interface based on a Silicon Graphics spec that lets developers create apps that incorporate sophisticated 3-D graphics.

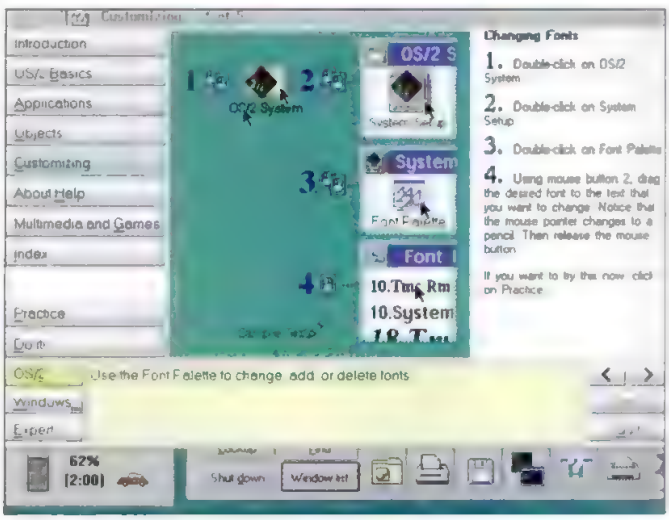
Keep in mind that when Windows 95 is available, the two environments will overlap in some areas. In fact, those who suggest that Windows 95 is a Trojan horse for Windows NT may not be so far off. The crystal-clear demarcation between Windows 95 and Windows NT is that Windows NT 3.5 won't support DOS TSRs or 16-bit device drivers, so don't switch now if you depend on them. If there's any one overall conclusion to draw about operating systems for 1995 and beyond, it's this: Memory matters. The more you have, the better off you'll be, no matter which OS you use.

desktop, or is Windows for Workgroups enough? Should you wait for Windows 95? Important features are spread across Windows NT 3.5 and Windows 95. For example, Windows 95 will fully implement Plug and Play, but Plug and Play won't be in Windows NT until the next release, which has no timetable yet. On the other hand, full support for the OpenGL 3-D graphics library is in Windows NT 3.5 now, but it won't be supported in Windows 95 until that environment's second release, and no one knows when that will be. Windows NT Workstation also has the powerful ability to run DOS and 16-bit Windows apps in their own memory spaces.

According to Microsoft, making a choice should be easy. There are two scenarios. In one, you have a 386- or 486-based system with 8MB of RAM and you mainly use mainstream business applications. In this scenario, you should be using Windows for Workgroups now, and Windows 95 when it's released.

In the other scenario, you're a scientist or an engineer, you use processor-intensive applications to do statistical or data analysis, you need a high level of security and crash protection, and you run at least a 486 with 12MB RAM, though it would be better if you had 16MB or 32MB. You need Windows NT.

Suppose, though, that you're running mostly business apps but you'd *like* extra security and better crash protection, and your PC is a 66-MHz 486 with 16MB RAM. Which operating system do you choose in this case?



OS/2 Warp, Version 3, features entirely new interactive tutorials and help. You can practice new skills or have the OS simply do the task you're trying to learn.

LEAVING WINDOWS BEHIND

And where does OS/2 Warp fit into your buying decision? IBM positions it squarely against Windows 95. It's true that OS/2 Warp will run your DOS applications (and games) even better than DOS, and will run your favorite Windows applications as well as Windows 95 will (though not very well in the 4MB of RAM that IBM claims it can work in). But OS/2 Warp is a 32-bit operating system with enhanced crash protection (as in Windows NT 3.5), and it uses an object model similar to what Microsoft promises in future versions of Windows NT. With a powerful suite of applications—word processor, spreadsheet, and communications—bundled with OS/2 Warp, OS/2 Warp has been positioned by IBM as a better value than Windows 95 or Windows NT. Whether or not it is better depends on whether or not you find the BonusPak of applets valuable.

OS/2 WARP: EASY TO INSTALL

Does OS/2 Warp install easily? Definitely. The OS does a remarkable job of automatically identifying your system's components (down to your video chip's manufacturer) and setting itself up appropriately. We installed OS/2 Warp on several different systems and encountered no compatibility problems with hardware devices. It's still difficult and needlessly complex to change system settings, however. We tried changing a graphics card in one test system and barely succeeded. Changing such system hardware requires what OS/2 Warp calls a Selective Install, and the process, beginning with the name, was anything but intuitive.

You should also know that if you're installing OS/2 Warp over Windows or Windows for Workgroups, you'll need your original Windows disks. Don't attempt to install the version of OS/2 Warp that installs over your existing Windows unless you have those disks. You won't succeed.

OS/2 WARP: EASY TO USE

Is OS/2 Warp easier to use than previous versions? Yes. For the first time, OS/2 really has become an end user's operating system. Not only is its new dashboard like LaunchPad a great way to start programs with a single click, but the Desktop is easier to customize and more accessible even to those who don't want to learn

The Magic of Multiprocessing

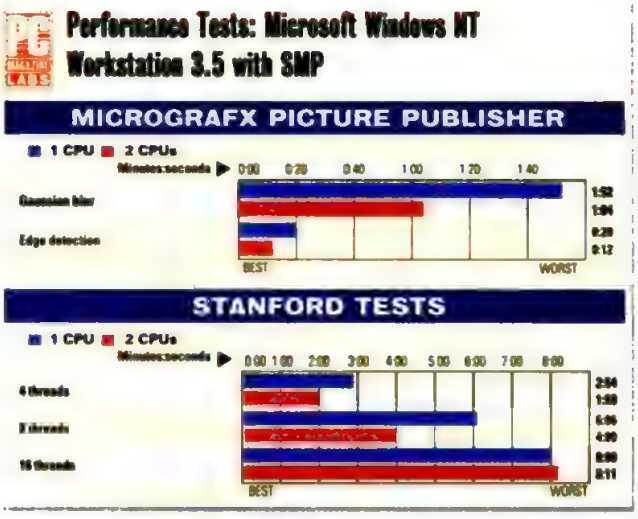
By Deval Shah and Dan Smith

One factor that differentiates both OS/2 Warp, Version 3, and Windows NT Workstation, Version 3.5, from the upcoming Windows 95 is their ability to run with more than one processor using proprietary symmetric multiprocessing (SMP) or the new Intel Multiprocessor 1.1 specification. For this evaluation of 32-bit operating systems, we were able to test Windows NT Workstation 3.5 on an Intergraph dual 90-MHz Pentium system with an Intel Neptune chip set. We could not, however, test OS/2 Warp's SMP version; IBM says the product will ship at some point in early 1995. (OS/2 2.11, multiprocessing is currently available on systems sold by ALR, Compaq, Tricord, and Wyse.)

SPEEDING UP TASKS

In testing, we found that SMP could speed up certain tasks by up to 68 percent, but it's important to note that these were calculation-intensive tasks in applications like Micrografx Picture Publisher, not I/O-intensive tasks as in big database applications. When we tried I/O-intensive applications, the performance gains dropped unless we installed a faster hard disk.

To see if SMP helped in a multithreading scenario, we ran the Stanford tests with an increasing number of simultaneous threads. We found that SMP was a big performance booster, though it tapered off at 16 threads.



We also found that there is a certain amount of overhead incurred while running an SMP kernel, so unless the application you are running is designed to take advantage of the multiprocessing capabilities of the underlying operating system, the application may actually run *slower* when you have two processors. We saw this happen when we compared running a Microsoft Excel for Windows NT–based macro on a system with one processor against running the macro on the same system with two processors installed.

We found, too, that the performance actually dropped with two CPUs running.

A handful of users will benefit greatly from the ability of both OS/2 Warp and Windows NT Workstation to use two or more processors on the desktop. These users, however, will be primarily CAD and high-end graphics specialists, at least for now. Most other users will find little reason to try symmetric multiprocessing, except on application servers or SQL servers. □

about objects and properties.

There are some subtle changes to the look of the new OS/2. Many icons now pop up and fold out, and it's easier to tell which icons are open and in use. These are small improvements, but they make a world of difference in usability.

IBM has long maintained that its System Object Model (SOM) Desktop is easier to use than the File Manager/Program Manager combination found in Windows and Windows NT today. Despite the fact that dragging a file icon to a printer icon to print is impressive, the nuances of OS/2 and SOM remain hard to appreciate. That's why OS/2 Warp has a greatly improved on-line help system and a brand new interactive tutorial.

The on-line help system that comes with OS/2 Warp is much better than the one that came with OS/2 2.11. The help system actually does help, but the help system improvements pale in comparison with OS/2 Warp's new tutorial. This dramatic new tool is more than a tutorial; it's a mini-help system that can lead you into the basics and beyond. It not only teaches, but even executes requests for you.

Each help topic—Basics, Applications, Objects, Customizing—tells you how to do something, but then the system goes beyond teaching. Each topic has a button labeled "Do it," so you can take the action you're trying to learn about and see how it happens. Besides allowing you to practice activities while viewing the help descriptions, the help system reaches out to Windows users by translating Windows actions into OS/2 Warp actions.

OS/2 also comes with a new software utility called PlayAtWill, which, while not a complete implementation of Plug and Play, does implement Plug and Play–style socket services for PCMCIA cards. Your PCMCIA card is automati-

Our Contributors: RICK AYRE is an executive editor at *PC Magazine*. DEVAL SHAH and DAN SMITH are technical analysts at PC Magazine Labs. DENIS TOM is a support technician at PC Magazine Labs. DON WILLMOTT was the executive editor in charge of this story, and AMARENDRA SINGH was the project leader.

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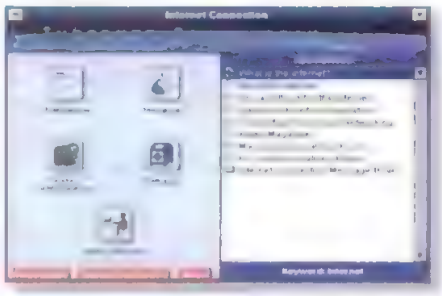
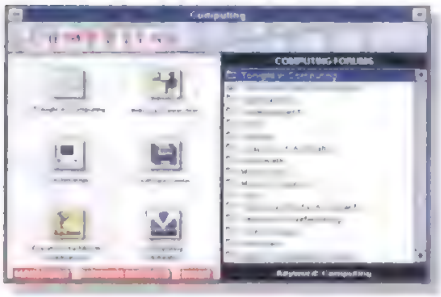


Internet Connection



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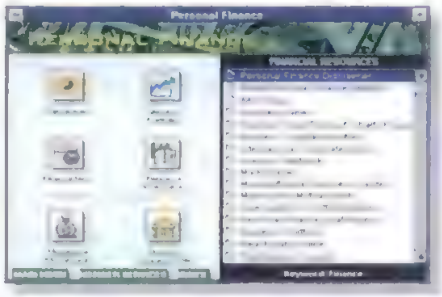

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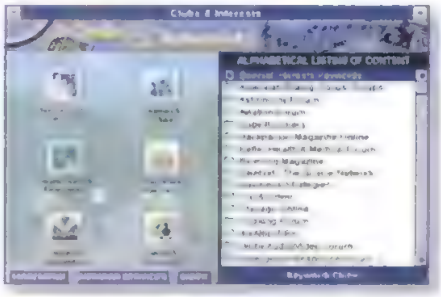

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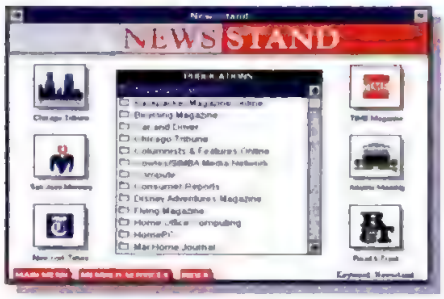

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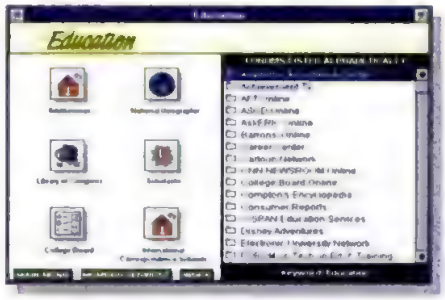

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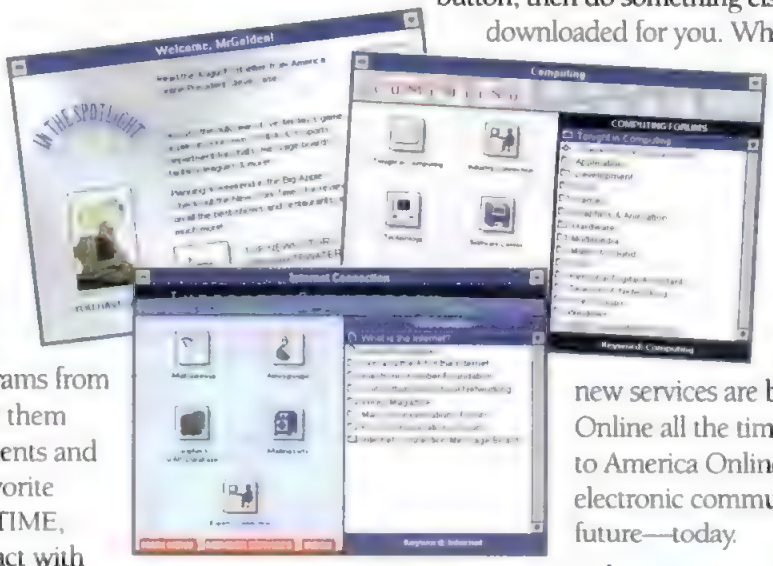

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IBM OS/2 Warp, Version 3

List price: $129, "fullpack" edition for users without Windows, $199. Estimated street price, $79, "fullpack" edition, $129. **Requires:** 4MB RAM, 40MB hard disk space. **In short:** The new multitasking, multiprocessing OS/2 can run in 4MB RAM (though you'll want more memory for better performance), has a friendlier, object-oriented interface, and comes bundled with a suite of applications including strong communications tools and excellent direct Internet access, virtual whiteboard-like conference tools, and multimedia viewers. Its performance, while slower than that of Windows for Workgroups, matches that of Windows NT Workstation, Version 3.5, in many tests.

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SUMMARY OF FEATURES

OS/2 Warp and Windows NT Workstation

Products listed in alphabetical order	Microsoft Windows for Workgroups 3.11	Microsoft Windows 95*	Microsoft Windows NT Workstation 3.5	OS/2 Warp 3
List price	$219.95	Info not available	$319.00	$129.00
Upgrade price	$89.95	$100.00 (est.)	$99.00	None
RAM required	4MB	4MB	12MB	4MB
Hard disk space required	12MB	25MB	90MB	40MB
Runs 16-bit Windows applications	■	■	■	■
Runs 32-bit native applications	□	■	■	■
Handles 16-bit device drivers	■	■	■	■
Preemptive multitasking	■	■**	■	■
Multiprocessing	□	□	■	■
Preemptive multithreading	□	■	■	■
CompuServe access	□	■	■	■
Internet access	□	■	■	■
Built-in support for NetWare	□	■	■	□
Built-in support for TCP/IP	□	■	■	■
Built-in support for Win32s	■	■	■	■
Peer-to-peer networking	■	■	■	□
Plug and-play	□	■	□	■ (PCMCIA only)
Supports remote access	□	□	■	□
Supports multimedia	□	■	■	■
Bundled business applications	□	□	□	■

** Microsoft Windows 95 will multitask DOS and 32-bit applications

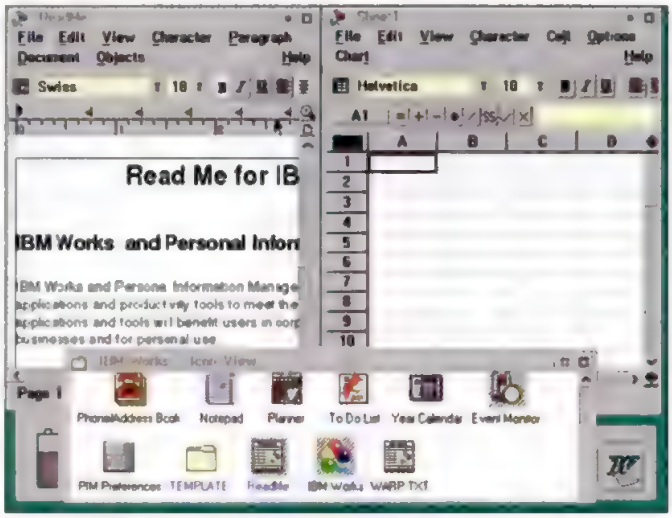
cally installed and configured as soon as it's inserted, whether it's a modem, memory, or I/O device.

OS/2 WARP: GOOD VALUE?

Is OS/2 Warp a better value than previous versions of OS/2? Perhaps. In the included BonusPak, IBM bundles applications that take advantage of the OS/2 Warp's object model while addressing users' concerns about the lack of native OS/2-based applications. Most impressively, the BonusPak includes excellent Internet access tools.

Among the included apps are Hyper-Access Lite for general communications; the CompuServe Information Manager (CIM) for OS/2 that makes access to CompuServe easy; and Fax-Works for OS/2 for all your faxing needs. You get Person to Person for OS/2, a real-time desktop conferencing application; Mulitmedia Viewer, which lets you display thumbnails of multimedia data objects instead of less descriptive file names; and Ultimedia Video IN for OS/2, which gives you what IBM calls WIN/TV, the ability to view TV signals on-screen (assuming you have the hardware to provide such signals).

You also get IBM Works, an integrated package with a word processor, spreadsheet, database, charting package, report writer, and personal information manager. Works is SOM-enabled to show off what an application that is tightly integrated with the Workplace Shell can be like (drag a document to the fax icon, for example, and it faxes automatically). But while IBM Works may be a good demonstration of native OS/2 apps in action, it's not a particularly good example of an integrated application, and its components are far from state of the art.



OS/2 Warp's BonusPak includes IBM Works, an integrated bundle of object-oriented applications—including a word processor and spreadsheet—that have interesting drag-and-drop capabilities.

Much more compelling is the Internet bundle; it's a little suite unto itself. You get TCP/IP and the utilities to connect asynchronously using SLIP/PPP, basic FTP and Telnet programs; Ultimail/2 Lite; a Usenet news reader; a gopher client; and a World-Wide Web browser. To top it off, IBM includes a connection utility so you can get connected to the Internet with a few mouse clicks. By default, you get connected to the IBM Global Network, an IBM-associated Internet provider which may not be the cheapest way to gain access, but this Internet bundle is as easy to use as any Internet package we've seen. And it can be configured to connect via the Internet service provider of your choice.

The version of IBM's WebExplorer that ships with OS/2 Warp is prerelease software, but a program that comes with Warp—run by clicking on the icon "Retrieve Software Up-

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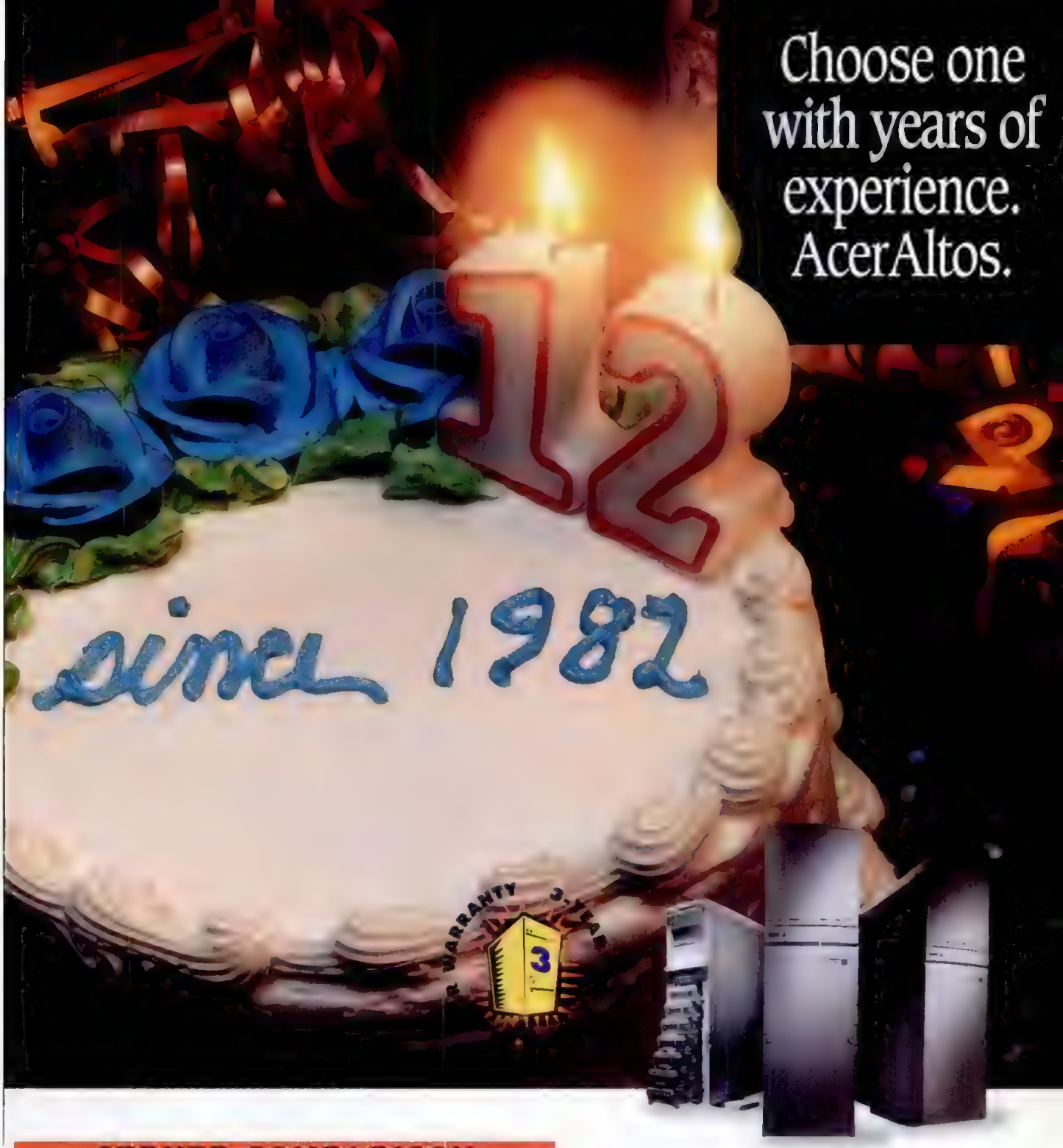

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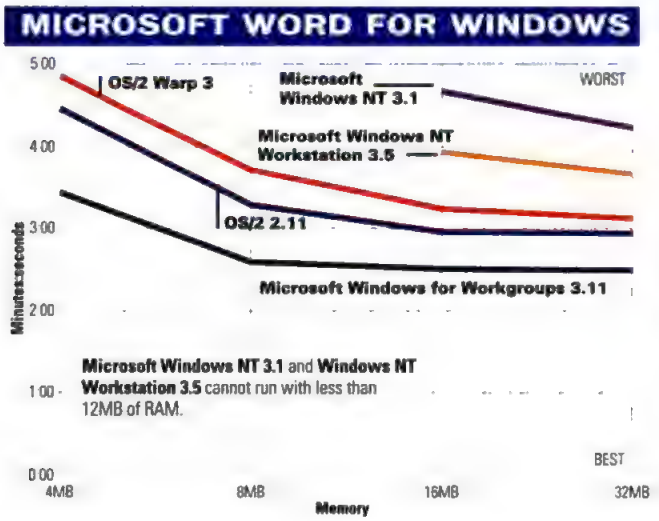
Performance Tests: OS/2 Warp & Windows NT 3.5

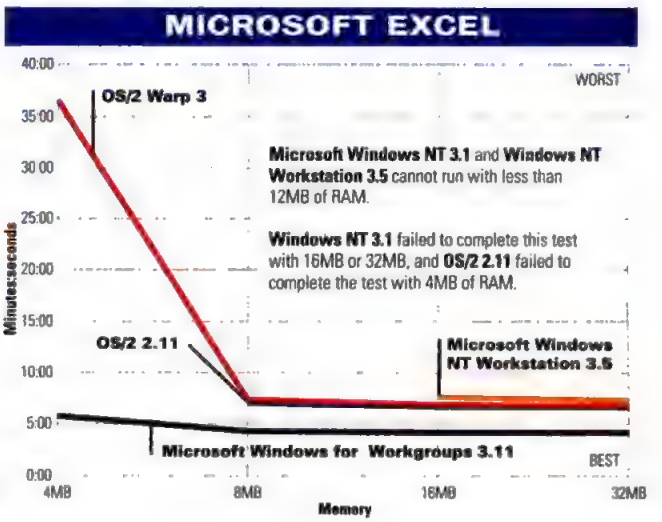
Pay attention to these test results if you're planning to take some of your 16-bit applications with you as you migrate to a 32-bit operating system. Our testing showed that you should expect to sacrifice some performance in such a move, though the size of the performance hit may differ. We didn't see as dramatic a performance range on our Microsoft Word for Windows test as we did on our Microsoft Excel test. Testing also showed that the more memory you add, the better the 32-bit operating systems perform.

For testing operating systems, we run 16-bit application macros in Microsoft Word for Windows 6.0 and Microsoft Excel 5.0. We launch Word and Excel from the Microsoft Office Manager (MOM) toolbar.

For the **Microsoft Word for Windows** test, we use the search-and-replace, spell-checking, and column-formatting tools, and we change fonts within in a Word document. We also import a WordPerfect document, as well as a WordPerfect graphical file. We print both documents to a file using an HP LaserJet III printer.

For the **Microsoft Excel** test, we move, copy, paste, and average cell values. We also generate line, 3-D bar, and pie charts, and we print a 34-page and a 50-page spreadsheet to a file using an HP LaserJet III printer.





dates"—will download the final version of WebExplorer, which will be available late in 1994.

WINDOWS NT: CONNECTED AND SECURE

Is Windows NT 3.5 better for networking than its predecessor? Yes. When Microsoft launched Windows NT 3.1 last year, it claimed a NetWare requester soon would be released by Novell. As days stretched into months, Microsoft rushed to write its own requester, which it eventually supplied to all NT users who needed it. Fortunately, Windows NT 3.5 comes with connectivity options to spare, all in the box.

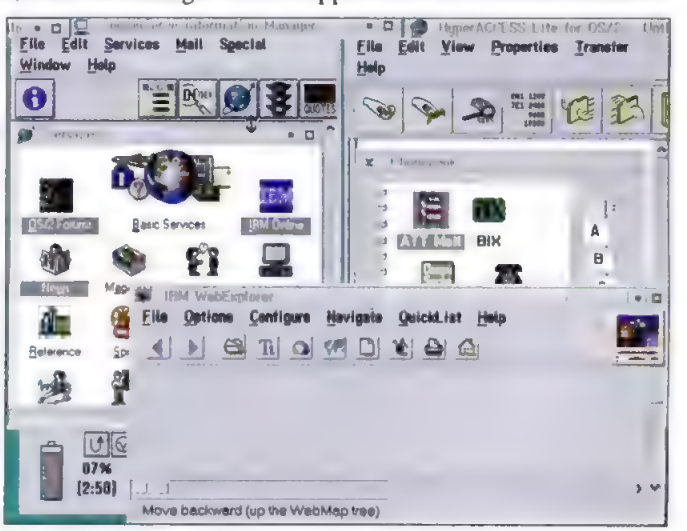
New in Windows NT 3.5 is Microsoft Client Service for NetWare, a Microsoft product from the ground up. Through it, Windows NT 3.5 users can access NetWare file and print services and application servers. Included are the new Microsoft IPX protocol and SPX II, which includes impressive multiple–network support.

In addition you'll find a new and improved TCP/IP stack that provides automatic configuration and name resolution capabilities, and NetBEUI support using the Point-to-Point Protocol. Also built into the improved Remote Access Services is support for SLIP/PPP so that the OS can be used to achieve a full Internet connection. The Internet support in Windows NT 3.5 is not as complete as that of OS/2 Warp, nor is it as easy to use, but several large help files are included on the topic "Connecting to the Internet." Using Windows NT 3.5, we were up and running on the Internet in a few minutes.

Windows NT 3.1 was already the most secure desktop running on an *x*86 machine, but Windows NT 3.5 has improved security further still. A new feature has been added that lets you lock out an account after a specified number of unsuccessful log-on attempts. That's the kind of high-end feature that destines Windows NT 3.5 for mission-critical work.

WINDOWS NT: BETTER APPLICATION SUPPORT

Has Windows NT enhanced its applications support? Yes. Windows NT 3.5 now



The OS/2 Warp BonusPak also has a great set of communications tools, including CIM for OS/2, HyperACCESS Lite for OS/2, and IBM's own Mosaic-style Web browser for easy Internet access. OS/2 Warp lets you multitask communications sessions, too.

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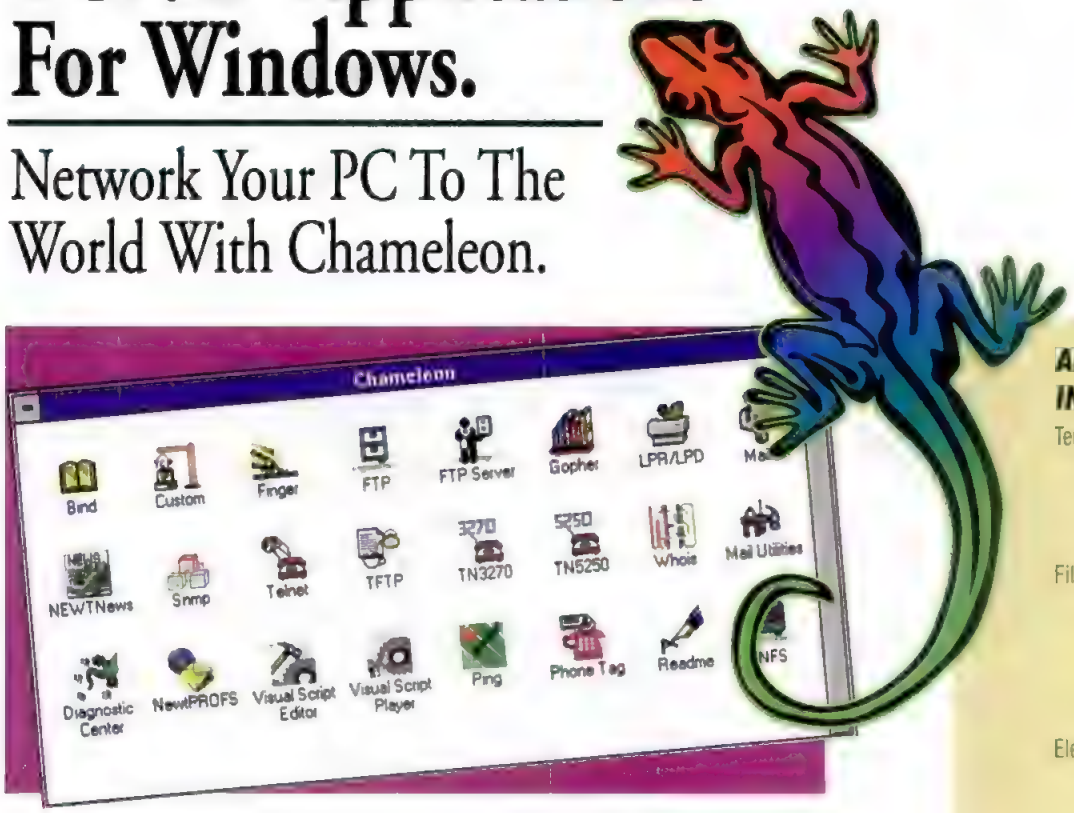

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  - Windows interface to IBM PROFS mail
- Internet Access
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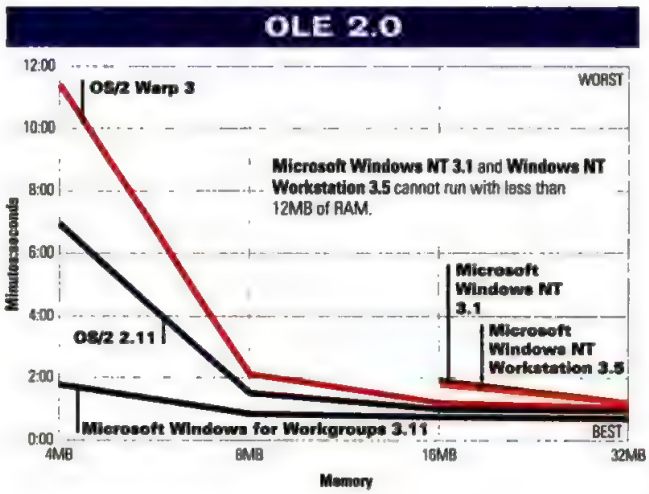
Performance Tests: OS/2 Warp & Windows NT 3.5

OLE 2.0 test results will be important to you if you're concerned with interapplication communication, an increasingly essential part of computing that involves sharing toolsets, such as spelling and charting modules. Our testing indicated that OS/2 Warp 3 was a better OLE 2.0 performer than Windows NT Workstation 3.5, though it was slightly slower than Windows itself. Testing also showed that the more memory we added, the better both OS/2 Warp and Windows NT Workstation performed.

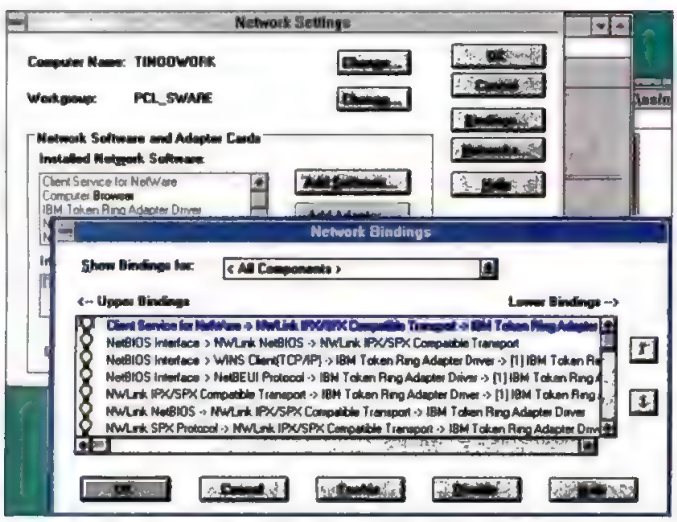
The **OLE 2.0** test suite consists of three applications: Borland Paradox 5.0, Microsoft Excel 5.0, and Microsoft Word for Windows 6.0. We click on OLE objects (WordArt, an Excel chart, and a Paradox table) to get the toolset of the applications that created them and edit the objects. We first bring up a document in Word that contains OLE 2.0 objects and edit the WordArt object, launch Excel from the Word toolbar, open an Excel chart, and drag and drop it into Word. We then use the Excel table toolbar in Word to embed a 4- by 4-cell Excel spreadsheet for in-place editing. Then we click on the embedded Paradox table object and use the filter tools.



includes the OpenGL graphics API for high-end graphics. It has better crash protection for 16-bit Windows applications and lets you run them either in separate virtual device machines (VDMs) or in one VDM, as in Windows NT 3.1. The environment has complete 32-/16-bit OLE 2.0 support, too.

The inclusion of OpenGL will not lead to visible improvements immediately, but in the long run you'll see the difference. OpenGL will make animation and 3-D graphics—now found only on the high-end workstations—possible on PCs. With Windows NT 3.5, developers can deliver such graphics to price-conscious end users. Moreover, the graphics will look the way they should as long as you use a graphics card that Windows NT 3.5 supports.

Of course, what really matters is whether software developers are designing 32-bit productivity applications for Windows NT. Where, for example, is Microsoft Office for Windows NT? The good news is that Windows NT–specific versions of Microsoft Excel 5.0 and Microsoft Word 6.0 were on the verge of being released at press time and the late prerelease versions we examined were full and successful implementations of those popular apps.



Faster and better networking tools right in the box, including a new IPX/SPX and new TCP/IP stacks, are a highlight of Windows NT Workstation 3.5.

PERFORMANCE TESTING

We tested the operating systems on two different system setups. We ran the Stanford test suite and our OLE 2.0 test suite 33-MHz 486DX Compaq machines with QVision graphics cards and 340MB hard disks. We ran the application macros and WinBench tests on 60-MHz Pentium systems with Diamond Stealth 64 graphics accelerators and 420MB hard disks. As we tested different memory configurations, we used cache and swap file settings that the vendors recommended for optimal performance.

Overall, the tests proved the obvious: Windows for Workgroups is faster than either of the 32-bit operating systems when it comes to running Windows applications. Windows NT 3.5 was a top performer on tests involving workstation-style tasks, and on most tests, OS/2 Warp fell somewhere in between Windows and Windows NT 3.5.

Interestingly, OS/2 2.11 was faster than OS/2 Warp almost across the board, despite the fact that when we used OS/2 Warp it *seemed* faster than OS/2 2.11. IBM says that OS/2 Warp was, in fact, designed to respond to user input faster than OS/2 2.11, and therefore it seems "snappier" when you use it.

16-BIT APP PERFORMANCE

To test OS/2 Warp and Windows NT 3.5, we started with 16-bit Windows applications performance.

Normally, PC Labs' tests of choice in this scenario are Winstone 95, our application-based system performance tests. Unfortunately, Winstone 95 won't run under OS/2 Warp because OS/2 doesn't support some necessary Windows API calls. So instead, we developed application scripts that launched and ran two popular business apps and had them perform tasks similar to the tasks in Winstone 95.

The results were hardly surprising. Windows for Workgroups 3.11 was consistently the fastest, OS/2 Warp was next (though far behind Windows), and Windows NT 3.5 was slightly slower than OS/2 Warp. Windows NT 3.5 did, however,

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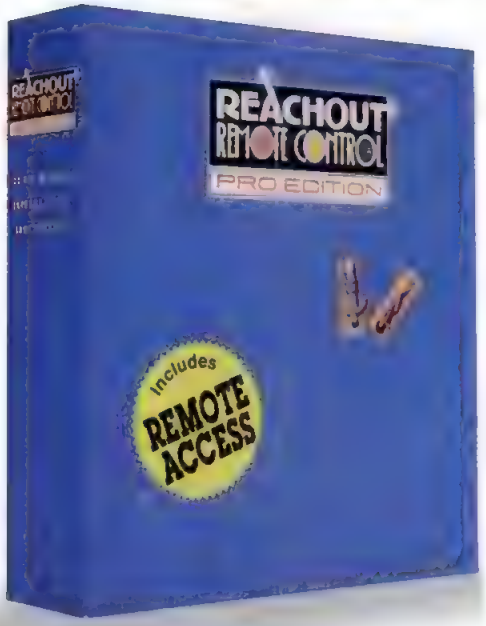

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- #1 Overall Power
- #1 Overall Usability
- #1 Performance
- #1 Versatility
- #1 Ease of Learning
- #1 Ease of Use

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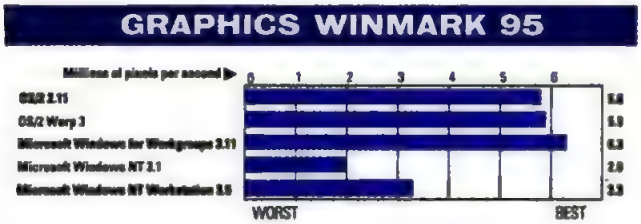
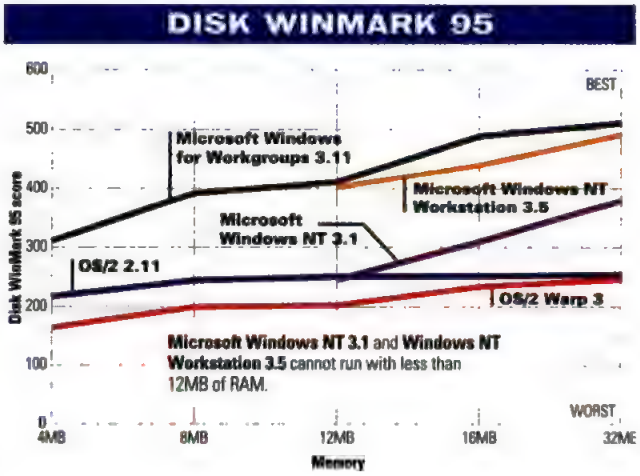
PCM1294

Benchmark Tests: OS/2 Warp & Windows NT 3.5

Because the tests that make up WinBench 95 are based on profiles of an extensive mix of Windows applications, the scores they generate offer a broad sense of how 16-bit applications will perform under OS/2 Warp 3 and Windows NT Workstation 3.5. They're also slightly more granular than our application-macro tests in that they focus on graphics and disk activity. Results on our Graphics WinMark 95 tests, which proved not to be sensitive to changes in memory, showed OS/2 Warp 3 and Windows NT Workstation 3.5 perform about the same. Disk WinMark 95 scores improved as we added more memory, and Windows NT Workstation performed better than both tested versions of OS/2—and almost as well as Windows for Workgroups 3.11. Windows NT has always had a very good disk cache, and Windows NT Workstation 3.5 is no exception.

Graphics WinMark 95 and **Disk WinMark 95** operations are based on extensive profiling of 13 of the leading Windows applications. The test scores reflect the types of graphics calls and disk operations made by these applications.





catch up as we added more memory.

The conclusion is that you really need 16MB of RAM to run NT. Windows for Workgroups peaks at 8MB, but if you need or want the features of a 32-bit OS and have 8MB of RAM, don't consider anything but OS/2 Warp.

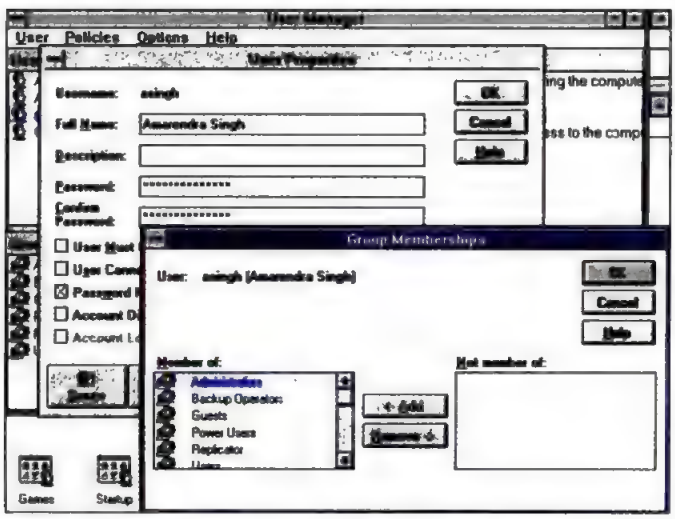
OLE 2.0 PERFORMANCE

To test the operating systems for cross-application communications, we took a look at OLE 2.0 performance. Since OLE is notoriously hungry for system resources, we knew it would be a tough test, and we constructed our OLE test suite to push the limits.

We tested OS/2 Warp and Windows for Workgroups with 4MB RAM. The surprise was that only OS/2 could complete the tests with that little memory. Though performance was slow, both OS/2 2.11 and OS/2 Warp struggled through to conclusion. We tested all of the OSs with 8MB RAM, even though we know Microsoft says 8MB is insufficient to run NT. Nevertheless, Windows NT 3.5 was able to complete the test.

Most of the OLE test results were unsurprising. Windows for Workgroups was fastest by a considerable margin. OS/2 Warp came in second, and Windows NT 3.5 was third. OS/2 2.11 was slightly faster than OS/2 Warp because we tested OS/2 2.11 using the WIN-OS/2 in OS/2 Warp installed over Windows for Workgroups. Our earlier memory tests showed IBM's WIN-OS/2 implementation to be faster than OS/2 for Windows.

All the environments got faster as we added memory. With 32MB RAM, both OS/2 Warp and Windows NT 3.5 performed about the same—both well behind Windows for Workgroups.



Windows NT Workstation 3.5 makes it simple to assign network group membership. Setting up peer-to-peer networks is relatively straightforward. It's a feature OS/2 Warp doesn't have.

SPEED SURPRISES

Some of the results from WinBench testing were surprising. On the Disk tests, Windows NT 3.5 performed almost as well as Windows for Workgroups. This was the only time when either OS/2 Warp or Windows for Workgroups were close in performance to Windows itself. And while OS/2 Warp trailed the pack on the Disk scores, OS/2 bested Windows NT 3.5 on our Graphics tests. There was little variation on the Graphics tests when more memory was added.

WinBench testing showed that both Windows NT 3.5 and OS/2 Warp have narrowed the performance gap with Windows for Workgroups. That's good news if you want to move up to one of the new operating systems and bring your 16-bit Windows apps with you.

MULTITASKING PERFORMANCE

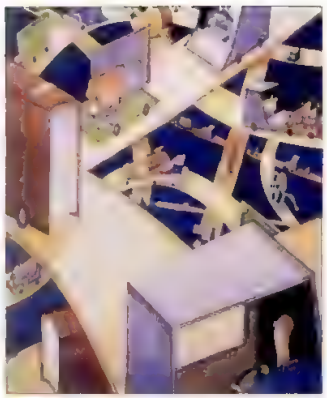
We compared the multitasking capabilities of OS/2 Warp and Windows NT 3.5 using operating system-specific versions of the Stanford test suite, a set of small, numerically oriented, CPU-intensive applications that illustrate how well the OS handles multitasking.

The results highlighted the high-end

Network utilities—vital, but set aside 100K

DOS 6 utilities—handy, but about 120K

Multimedia—fun, but can you spare 50-80K?



Internet utilities—where will you get 120K?

If you don't have QEMM 7.5, what else have you sacrificed?

Sooner or later, as you push the limits of your PC's capabilities, you will run into a wall. Memory limits. Drivers that won't load. Crashes. "Out of Memory" messages. And you'll run into this wall whether you have one megabyte in your PC or 16.

That's why millions of people, from PC gurus to novice users run QEMM®. It fixes memory problems and keeps your PC performing at its best.

Introducing QEMM 7.5 It Makes Room for All the Good Stuff

Our newest QEMM takes into account the greater demands you're putting on 'conventional' memory today: device drivers, sound cards, disk compression, caches, network utilities, CD ROM drivers, etc. Not to mention all the stuff you want for tomorrow, like the drivers you'll need for Internet utilities. It finds room for all those things so you don't have to sacrifice capabilities you want—now or in the future.

MemMaker, the memory utility that comes with DOS 6, does an OK job of delivering additional memory, but it just hasn't kept up with demanding users.

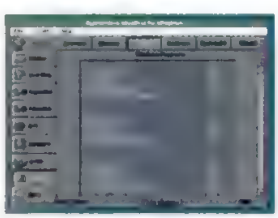
Say you wanted to run a mouse, sound card, SmartDrive, your DOS 6 and Novell utilities, and your Microsoft Bookshelf '94 CD ROM. You couldn't with MemMaker. Not unless you were willing to manually 'tune' it. And then you might end up with 490K or so to use. But QEMM 7.5 routinely returns 634K of conventional memory. And when you consider as little as one 'K' of memory makes the difference between a program loading or not, you can see where an additional 140K or so could be vital.

Hot new features

- 100% Windows installable
- Faster 32-bit memory model
- PCMCIA support
- *Stealth Stacker* saves 8-32K
- *QuickBoot* saves time
- *Optimize/Restore* lets you revert to recent settings

A side benefit of running QEMM is that with memory 'elbow room' you get more reliability—fewer crashes and hangs. And some programs (especially games) run faster and smoother.

When you run DOS programs in Windows, QEMM 7.5 will provide benefits for those programs, too. Many productivity programs won't even run without it unless you sacrifice drivers and other goodies.



Our new Manifest memory analyzer now runs in Windows. And it's still free with QEMM.

QEMM 7.5 comes with a new version of our award-winning memory utility, Manifest, which reports details you can't find out any other way—like how Windows and the programs running under it are using memory or what software is using your IRQs.

There are dozens of new features and improvements to our new QEMM, making it even faster and safer. Find out for yourself. Visit your favorite software dealer or call (800) 571-4860 for a free brochure.

Stop making sacrifices. Get QEMM 7.5—the safest, most powerful memory manager for Windows, DOS and games.

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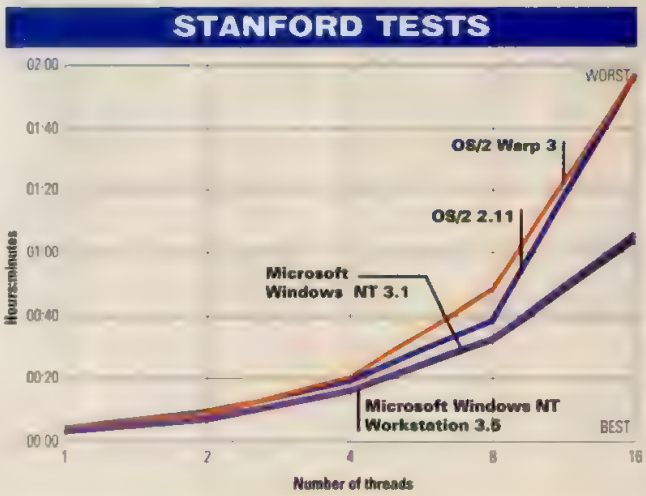
Quarterdeck International Ltd., B.I.M. House, Crofton Terrace, Dun Laoghaire Co. Dublin, Ireland Tel. (353) (1) 284-1444 Fax: (353) (1) 284-4380
Registered U.S. users of earlier versions of QEMM may purchase upgrades from dealers or direct from Quarterdeck for $29.95 plus $5 shipping & handling. Call (800) 354-4757.

CIRCLE 904 ON READER SERVICE CARD

Performance Tests: OS/2 Warp & Windows NT 3.5

Our Stanford tests measure the high end of performance for both OS/2 Warp 3 and Windows NT Workstation 3.5. They use only CPU-intensive calculations—the kind found in graphics applications such as CAD programs—and multithreading, which gives simultaneously running applications a more responsive feel. It's no surprise that Windows NT Workstation 3.5 excelled on these tests. Though we ran these tests with multiple memory configurations, the results were the same at both 16MB and 32MB of RAM. We report results at 16MB.

The **Stanford tests** measure each system's multithreading ability. We run each routine as a single process and then as 2, 4, 8, and 16 concurrent processes. These processes each consist of a series of algorithmic tasks. Fast Fourier Transformation, Floating-Point Matrix Multiply, and Mandel are used for floating-point operations. Integer operations include Bubble, which performs a standard bubble-sort algorithm using two nested loops; IntMM, which performs a matrix multiply on integer arrays; and Puzzle, a compute-bound algorithm that employs many nested loops. We also add the Queens, Quick, Towers, and Tree algorithms to form a series of recursive tests.



functionality of Windows NT 3.5. One thread executed about as fast under Windows NT 3.5 as under OS/2 Warp, but 16 threads executed twice as fast under Windows NT 3.5 whether we were testing with 16MB or 32MB RAM.

If high performance multitasking is what you need and you have applications that take advantage of it, then Windows NT 3.5 seems the clear choice. Keep in mind, though, that OS/2 Warp runs these tests, including the full 16-thread multitasking tests, with 8MB RAM.

WHAT TO DO

If you have the resources—no less than a 66-MHz 486 system with 16MB RAM—then Windows NT 3.5 is the Windows to buy today. It's secure and has crash protection and the Windows interface you know and are comfortable with. You can use your 16-bit Windows apps, or upgrade to the 32-bit version of Microsoft Office. Either way, you can be very productive. One caveat: You can't run DOS TSRs or 16-bit device drivers under NT, so if you have some that you depend on, you're stuck with Windows for Workgroups—at least for the time being.

One disappointment with Windows NT 3.5 is its lack of Plug and Play support. Though we are promised support in the next release, it may seem a long time away for those holding PCMCIA modems and network cards today. Hardware vendors may write their own drivers, of course, and by all accounts the socket support is very good; but there is only one PCMCIA driver in the box as Windows NT 3.5 ships today.

If you don't have the hardware to handle Windows NT 3.5 and you want 32-bit performance and crash protection, then OS/2 Warp is your only choice right now and it's a good choice. You'll have to learn a slightly different way of dealing with your desktop, but you won't have to leave your 16-bit apps behind. OS/2 Warp's biggest problem is the same one that has haunted all previous versions: a lack of mainstream business applications. □

FACT FILE

Microsoft Windows NT Workstation, Version 3.5

List price: $319. **Requires:** 16MB RAM, 90MB hard disk space. **In short:** The new desktop version of Windows NT has better built-in networking features, including a new TCP/IP stack and strong peer-to-peer networking, OpenGL support for 3d graphics; remote access tools; and symmetric multiprocessing power that demands high-end hardware. It has crash protection for 16-bit apps and full 16- and 32-bit OLE 2.0 support. The interface remains Windows-like; it doesn't include the upcoming interface featured in Windows 95.

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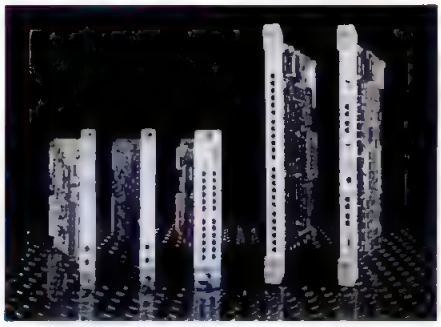
Add-on Printer Module	PSN3	69

CIRCLE 150 ON READER SERVICE CARD

Network Edition

The latest network products and management techniques



Token-Ring Touch-Up, page NE31

First Looks

▶ NETWORK OPERATING SYSTEMS

NOS: The Next Generation

With the new versions of Microsoft Windows NT Server and OS/2 LAN Server promising better usability and more functionality than ever, is NetWare still right for you?

By O. Ryan Tabibian

Three new releases of network operating systems—Microsoft Windows NT Server, Version 3.5, Novell's NetWare 4.02, and IBM's OS/2 LAN Server Advanced, Version 4.0—are making enterprise networking easier than ever before. We found these next-generation network operating systems (NOSs) to offer simpler interfaces, easier installation for the new user, and—in the case of NT Server—a remarkably effective NetWare migration path for existing NetWare users. Indeed, so impressive are these products that even NetWare 3.12 customers may think twice before migrating to NetWare 4.02.

We tested NT Server and LAN Server Advanced against NetWare 4.02 (NetWare 4.1 was not available in time for this roundup.) We looked at a wide range of features, ease of use and of installation, and file performance, using NetWare 3.12 as a reference product for our benchmark tests.

Our performance testing was so exhaustive that Microsoft had to issue a patch for NT Server. But interestingly, even with the patch aimed at speeding

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The Networker

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Derfler & Greenfield:

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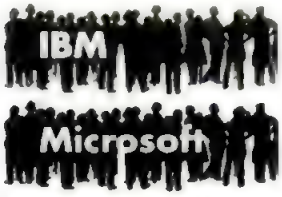
There are 7 crucial services your next network should perform.

(But try telling that to IBM and Microsoft)

Now that you're about to spend time and money on a next generation network, the last thing you want is a product that's not all there. Unfortunately, that's exactly what our competitors are trying to sell you. Because while your next network will need to perform way beyond file and print, those basics are all IBM and Microsoft can deliver today. And the truth is, even those aren't up to NetWare standards.

NETWORK USERS. THE VOTE IS IN.

*IDC Jan-June 1994 Server Network Operating Systems Node Shipments**
Novell: 72% / Banyan: 7% / Microsoft: 7% / IBM: 7% / DEC: 3% / Other: 4%



PROMISES ARE NICE BUT THEY CAN'T RUN A NEXT GENERATION NETWORK.

So what do the other guys deliver? Little more than a promise to provide you a full service network operating system somewhere down the road. Or maybe they can point you to a third party vendor. But that's not enough to run the network you need today.

You see, while IBM and Microsoft are just beginning to offer basic file and print services, networking requirements have been cruising ahead. In fact, networking with 32-bit NetWare 4 today encompasses more than just local workgroups and file and print, it's evolved to create a distributed network that speeds timely information directly to the people who need it. At the moment they need it most. That kind of feat demands a proven product, not just a promise. And right now Novell's NetWare 4 is the only one that can deliver.

WHY YOU NEED WHAT WE'VE GOT: THE MAGNIFICENT 7 EXPLAINED

Networking today means being able to hook up with people and information anytime, anywhere with a single login. Working like this requires seven crucial services from your network. One must is a directory service. No more looking for data in all the wrong places. Simply log in to the network once to get the info you need the moment you need it.

Built-in messaging lets you use most of the popular groupware packages such as E-mail, calendaring and others. And because it uses the same directory as the

network operating system, you're blessed with a single-point-of-administration.

Multiprotocol routing with NetWare gives you software-based routing (no new hassles, no new hardware) for connecting your network with the rest of the world. That way, you get the info you need anytime, anywhere, and you can collaborate with anyone, anywhere.

Network management with NetWare 4 lets you manage your entire network from a single-point-of-administration. And our graphical MS Window's management tools reduce repetitive, multistep tasks to a simple click of a mouse.

Security with NetWare 4 allows administrators to control access to sensitive information within a distributed environment. In fact, it was designed to meet the National Computer Security Center's Class C2 Network Security criteria.

And last but not least, file and print. Only NetWare 4 offers data migration, suballocation and compression so you won't have to buy extra hardware like the other vendors require. Simply put, our file and print services beat IBM and Microsoft cold on both performance and cost.

555 DAYS UP, 0 DAYS DOWN: ONLY NETWARE 4 IS ROCK SOLID TODAY.

Perhaps the nicest thing about NetWare 4 is that it doesn't just sound good, it works. And there's nothing like months of solid performance and happy users to prove it. Folks tell us NetWare 4 is a product they can count on today as well as tomorrow, that it has given them stability and performance, and has proven itself in business critical applications. Quite simply, NetWare 4 is doing everything they need it to do.

NOVELL'S SUPPORT ENGINEERS OUTNUMBER MICROSOFT'S 50 TO 1. WHO WOULD YOU RATHER CALL FOR HELP?

Buy NetWare 4 and when you call for help you'll get answers, not a runaround. Only Novell has over 47,000 Certified Novell Engineers (and 60,000 more in training) working with 20,000 Novell authorized resellers. Not to mention a veritable arsenal of everything from technology and solution partners to systems consultants and integrators. The point is, we don't sell you the product and disappear.

NETWARE 4 ISN'T JUST EASY, IT'S VIRTUALLY RISK-FREE.

On top of having the same basic architecture we've always had, NetWare 4 also features built-in migration tools so you can upgrade now. Backward compatibility to NetWare 3 means that applications written for NetWare 3 run on NetWare 4. And because you can manage NetWare 3 from a NetWare 4 server you can transition at your own pace. Installation and administration are more hassle-free thanks to NetWare 4's easy install option and the simplification of routine tasks to one intuitive step.

BUT WAIT, THERE'S MORE. HOW DOES A 300% RETURN ON INVESTMENT AND A FREE UPGRADE SOUND?

Research shows that approximately 70% of the cost of a network is administering and managing the network and its applications. By simplifying the administrative load, NetWare 4 slashes the cost of administering your network by roughly 25%. Add this to savings garnered by eliminating additional hardware expenses and it could equal up to a 300% return on your investment in NetWare 4. Better yet, if you buy 4.02 now we'll upgrade your network operating system free through March, 1995.

THE TRUTH AND NOTHING BUT THE TRUTH. ALL IN A FREE BROCHURE.

We'll be the first to admit that this is a lot of information for one ad to carry. And believe us, it's not all we have to say on the subject. The way we stack up against the competition is impressive. The product we've built over the past 11 years is proven. And you can get the nitty gritty details on all of it by calling 1-800-554-4446 now.

NOVELL

NetWare 4
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NEXT GENERATION NETWORK SERVICES.
READY OR NOT?

Services	Novell NetWare 4	Microsoft NT 3.5	IBM LAN Server 4.0
1 Directory	Yes.	No	No
2 Integrated Messaging	Yes.	No	No
3 Multiprotocol Routing	Yes.	No	No
4 Network Management	Yes.	Limited	Limited
5 Security	Yes.	Limited	Limited
6 File	Yes.	Yes.	Yes.
7 Print	Yes.	Yes.	Yes.

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CIRCLE 881 ON READER SERVICE CARD

file performance, NT Server still did not come out on top (For more information, see the Benchmark Tests on page NE12). We did compare NT Server with NetWare 4.02 as an application server using ServerBench, and we found that NT Server really stood out. As ServerBench was not available for OS/2, we did not run it on LAN Server.

Still, when the dust settled and our testing was completed, we had to award Microsoft Windows NT Server 3.5 our Network Edition Editors' Choice. NT Server simply provided the best combination of features, usability, a set of full but easy-to-use management tools, and the simplest and most impressive installation routine of any NOS we've seen.

Perhaps most notable though was a nontechnical feature: pricing. In this latest release of NT Server, Microsoft joins IBM in offering an innovative payment plan for its NOS, letting network managers pay a flat rate for each client, instead of paying to access each server. So to accommodate 100 simultaneous clients accessing a server, you would buy a 100-user license for each server. And there's the rub: As the number of servers increases so, too, does the per-user cost. IBM and Microsoft charge a flat rate ($50 and $39.95 respectively) for each user no matter how many servers that user accesses.

PC MAGAZINE NETWORK EDITION EDITORS' CHOICE

• Microsoft Windows NT Server, Version 3.5

In our testing and evaluation of network operating systems, we found Microsoft Windows NT Server, Version 3.5, was the most complete solution. Because of this, we've awarded it our Network Edition Editors' Choice. NT Server did not wow us with its file performance or remote management tools, but we could not overlook the overall package, which we felt offered the most impressive set of features. Version 3.5 includes the simplest installation routine of any product we've seen. We would even recommend Version 3.5 if you were upgrading from NetWare, since installing NT Server in a NetWare environment is no more difficult than upgrading from NetWare 3.12 to NetWare 4.*x*. NT Server also features a highly scalable environment with built-in symmetrical multiprocessing support and excellent management tools, including the Dynamic Host Configuration Protocol, which helps simplify IP address management.

Both NetWare 4.02 and OS/2 LAN Server 4.0 are also excellent products. NetWare 4.02 combines new, simple NetWare Directory Services installation with an enhanced GUI-based management tool—NWAdmin. NWAdmin is faster than its predecessor, and it offers more features, such as simpler configuration of printers. Even with NWAdmin, however, this latest version is still hampered by complicated management tools.

With its new set of management tools and simplified installation routine, LAN Server has positioned itself as a NOS that's both a top performer and easy to use. The new management tools are a far cry from the text-based, cumbersome management used in LAN Server 3.0. Its new facelift makes LAN Server ideal for any size environment. Despite making great strides in its driver support, however, LAN Server still offers far fewer drivers than the other products in its market.

NEEDS OF THE MANY . . . AND THE FEW

When you buy a NOS, management, scalability, and ease of use should be at the top of your checklist. The relative importance of each is determined by the number of servers on your network. In multiserver networks, management is key and that means you need to consider global directories, solid remote-management capabilities, and effective migration tools that help you upgrade to the NOS. If you have a smaller site, however, ease of use and effective management tools should be your key concerns.

Global directories track all network resources. This allows you, for example, to log on to the network once, not to each network service separately. While IBM, Microsoft, and Novell all provide some form of global directories in their products, there are differences. Reliability is one critical area. Novell's NDS is the most reliable of the directory services implementations, because it distributes directory information across multiple servers. IBM and Microsoft centralize information on one server—with assigned backup servers in case of failure.

There is a price to pay for NDS's distributed architecture and in this case it's ease of use and ease of management. NDS is initially quite difficult to install. If you have to link multiple groups over a WAN, NDS has many advantages over the IBM and Microsoft products, which let you put everyone in a single *domain*. Domain is an IBM and Microsoft term for workgroups of centralized

How to Migrate from NetWare 3.12

If you want to . . .	use . . .	which you can find in . . .
migrate to NetWare 4.0	MIGRATE.EXE	NetWare 4.02
migrate to Microsoft Windows NT Server 3.5	Migration Tool for NetWare	NT Server 3.5
connect NT clients to NetWare 3.12 servers	NWLink	NT Server 3.5 or NT Client 3.5
connect NT or OS/2 LAN Server clients to NetWare 3.12 servers without running NetWare redirectors	Gateway Services	NT Server 3.5 (for NT clients) or LAN Server Advanced 4.0 (OS/2 LAN Server clients)

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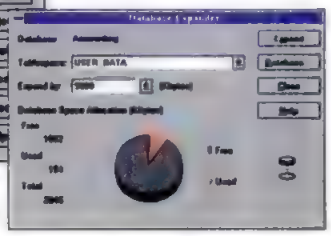
Friendly graphics indicate systems status.



Simple checkboxes & pick lists make administration easy.

PC MAGAZINE EDITOR'S CHOICE

10/11/94 Oracle7 Server for NetWare 7.0.16

ORACLE

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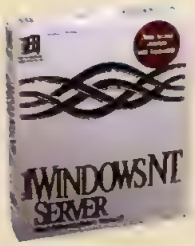
resources that are accessed via a single log-on.

Domains, too, have their faults. Multiple domains can only be linked through *trust relationships,* logical connections that allow one domain to authenticate users for another domain. The more domains, the more trust relationships and hence the higher the overhead associated with managing those relationships. What's more, with domains, all of your network information is stored on a single server. So in the event of a hardware failure, you might lose your map of the domain relationships. IBM doesn't employ this strategy; its domains are managed separately. Thus they avoid the problem of multiple trust relationships but incur the problem of having to manage each site separately.

Remote management is also an important tool to consider for a multiserver environment, especially if those servers are scattered across the country. All of the products here offer remote-management capabilities, but they do differ. NetWare offers the most in its remote-management solution by letting you take full control of a server from anywhere on the network. More limited are NT Server's remote tools, which allow few configuration changes to the server, and LAN Server's tools, which can only be accessed via an OS/2 client and a DOS client using text-based management tools.

When dealing with multiserver sites, look for migration tools that ease the transition from your current environment—which is often NetWare these days—to a new NOS or an upgraded version of the NOS you're running. NT Server was very impressive, letting us import all user information except passwords and log-on scripts from the server. LAN Server lacks these migration tools, but they should be available by the time you read this. But both provide a gateway service to NetWare servers that allows clients to access NetWare file and print resources. Surprisingly, NetWare 4.02 migration tools are limited, moving only NetWare 3.12's Bindery information. Like the tools in Windows NT Server, MIGRATE.EXE does let you model the imported Bindery informa-

What's New . . .



Microsoft Windows NT Server 3.5

- A management utility, the Dynamic Host Configuration Protocol (DHCP), dynamically provides IP addresses to users.
- Another management utility, the Windows Internet Name Service (WINS), assigns names to IP addresses.
- Built-in remote access with the addition of Remote Access Service (RAS).
- Support for an IPX/SPX-compatible network transport protocol called NWLink.

NetWare 4.02

- Easier installation of NetWare Directory Services (NDS).
- Incorporates 42 bug fixes for problems associated with NetWare 4.01, eliminating the time it would take to download the fixes from CompuServe.
- A faster and more capable administration utility called NWAdmin.
- Global naming.

OS/2 LAN Server Advanced 4.0

- Easier installation.
- A set of easy-to-use GUI-based management utilities.
- Enhanced client software with caching that improves overall network performance.
- Peer-to-peer capability at clients.
- GUI interface for clients.
- Expanded hardware support, including LAN adapters and SCSI controllers.
- Performance Tuning Assistant.
- Server-to-server TCP/IP communication using TCPBEUI.

Suitability to Task: Network Operating Systems

A network operating system (NOS) is judged by a number of factors, ranging from performance to driver support. In testing these products, we selected three categories that best define all of the network operating systems: scalability, management, and installation.

Scalability A NOS should be scalable so that it can satisfy your current needs as well as accommodate future growth. Accordingly, we look at a number of criteria: multiprocessor support—specifically the ability to scale up to four processors, support for a wide range of network protocols, and the level of remote-access capabilities. We also check to see if the NOS features a robust file system that supports built-in recovery mechanisms in case of a crash. We consider whether the NOS supports a processor-independent architecture that lets you run the same NOS on a number of different processors as well as a high-speed file system.

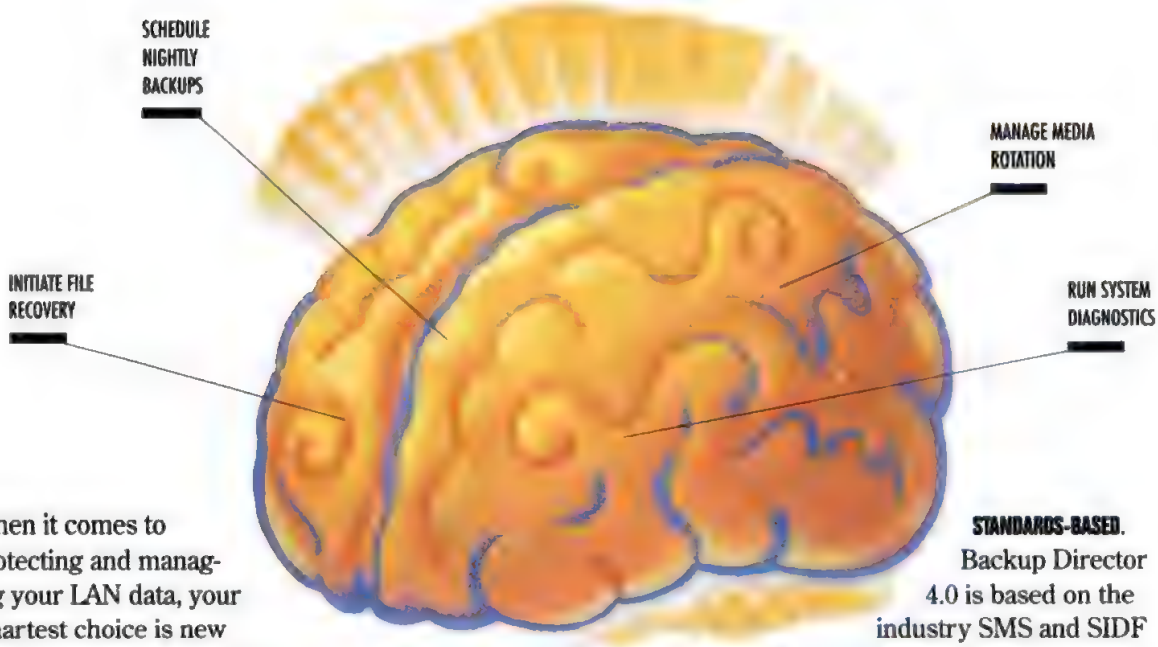
SUITABILITY TO TASK	Product Name
Scalability	EXCELLENT
Management	GOOD
Installation	AVERAGE

Management Management of your NOS should be both comprehensive and easy. We look at both the basic features—adding and deleting users, setting up printers, and granting access rights, as well as the complex features—file security, remote reboot, and IP management. Other important management considerations are remote-management capabilities, simple migration and upgrade tools, reporting features, audit trails, and intuitive tools that let you easily manage the servers.

Installation While installation is a one-time deal when it comes to NOSs, it's a process that must be seriously considered. Because installation is often a time-consuming and difficult task, an easy installation routine can enhance the usability of the product. For installation, we consider the ease of the setup process, driver support, autodetection of devices, and the complexity of the entire process.

BACKUP JUST GOT A LOT SMARTER.

PALINDROME INTRODUCES BACKUP DIRECTOR 4.0



When it comes to protecting and managing your LAN data, your smartest choice is new Palindrome Backup Director 4.0.

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tion. This allows you to determine whether or not you really want to commit to the upgrade.

For unconnected sites with only a few servers, what's most important is ease of use and installation, not global management. Our tests showed that NT Server is the easiest product to install. It had an unobtrusive installation routine; autodetection of hardware devices such as network adapters, SCSI controllers, and even modems; and support for a large number of device drivers. All this, combined with its powerful and easy-to-use management tools, made the product ideal for smaller environments. With its simplified installation and enhanced management tools, LAN Server is a good choice for smaller environments but it does require OS/2 expertise. Even with needed installation and management improvements, NetWare 4.02 is still too difficult to install and manage in small offices that lack NetWare expertise.

BIGGER AND BIGGER AND . . .

The second thing to consider in your evaluation process should be scalability. Scalability consists of factors such as multiprocessor support, multiprotocol support, and a way to add users easily to the network.

For unconnected sites with only a few servers, what's most important is ease of use and installation, not global management.

If you want a NOS that is truly scalable, look for one that supports symmetric multiprocessing (SMP). With SMP you can improve the performance of your servers just by adding more processors, a solution that is especially effective for larger sites with heavy database traffic. Both NT Server and LAN Server offer SMP support. SMP support for NetWare should be available by early 1995, shortly after the release of 4.1.

Another consideration is support for multiple protocols. Out of the box, NT Server really shines with support for a choice of four protocols at the client or the server (DLC, IP, NWLINK (a version of IPX), and NetBEUI). LAN Server lacks IPX support and can only run NetBEUI at the client. But it does support IPX encapsulated over NetBEUI. NetWare offers two protocols (IP and IPX) at the client and the server (For more information, see the Summary of Features).

The products we reviewed all offer compelling reasons to upgrade your NOS. Management is simplified because of better tools and the use of global directories. Performance is improved. And there is opportunity for growth. With all of that functionality in mind, you just might consider moving to the next generation.

Banking on the Future

By Robert P. Lipschutz

Novell, the undisputed leader in network operating systems (NOSs), faces a huge challenge in the coming years: upholding its dominance in the market. The company's first attempt at defending its title is its latest release of NetWare—Version 4.1, which was not available in time for our testing.

Novell hopes that the release of NetWare 4.1 will turn around the less than spectacular acceptance of NetWare 4.*x*. Up to now, NetWare 4.*x* has been a huge disappointment because of poor marketing, some annoying software bugs, and the product's restructuring—a frustration for diehard NetWare 3.*x* users. Novell promises to fix some of these problems with NetWare 4.1.

When Novell first introduced 4.0, most people thought it was just for large enterprise networks. NetWare 4.0's inclusion of NetWare Directory Services (NDS), a global directory service useful in large networks with multiple servers, supported this thinking. NDS provides transparent connectivity to multiple servers anywhere on the network. Along with the excitement, however, there came some confusing new concepts for network administrators and few benefits for small networks with a single server. This, coupled with a nontrivial upgrade process and expensive pricing, did not get NetWare 4.0 off the ground.

Now Novell will aim its marketing at both large enterprises and small workgroups. At the high end, Novell will soon introduce a more scalable version of NetWare 4.1 and SuperNOS. NetWare SMP, a new version of NetWare 4.1, will support symmetric multiprocessing, a first for Novell. Novell also announced its future direction for multiprocessing—a concept it calls Distributed Parallel Processing (DPP). Similar to the technology in use today on Digital VAX clusters, DPP allows multiple servers to act as one logical whole. In this way, mission-critical applications such as payroll and production databases benefit from the fault tolerance and performance of multiple systems. Finally, Novell recently announced SuperNOS, an integration of NetWare and UNIXWare. This will attempt to solidify Novell's presence in the application-server market.

As for the smaller workgroups, Novell improved the product by making installation easy for the small-scale network. The company also spruced up the Windows Administration utility. Lower pricing doesn't hurt, either. And Novell is now relying on its large accounts as well as the Novell Authorized Resellers to promote NetWare 4.1 to the masses.

One wonders about the future of NetWare 3.*x*. Novell will certainly continue selling NetWare 3.12, but will it continue developing on this platform? As customers demand more from their networks than just file and print services, Novell hopes NetWare 4.1 will satisfy their needs and become the platform of choice. □

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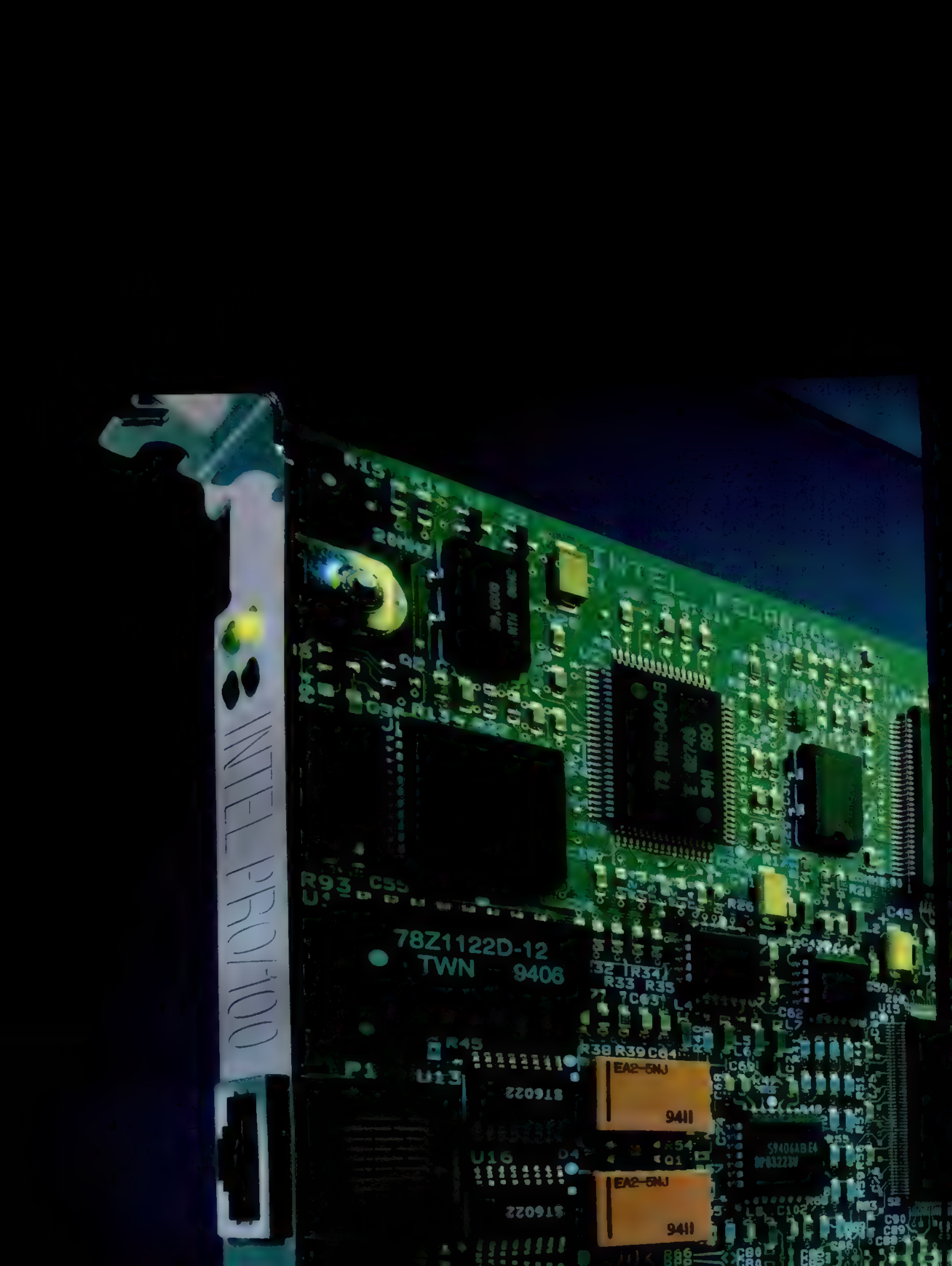
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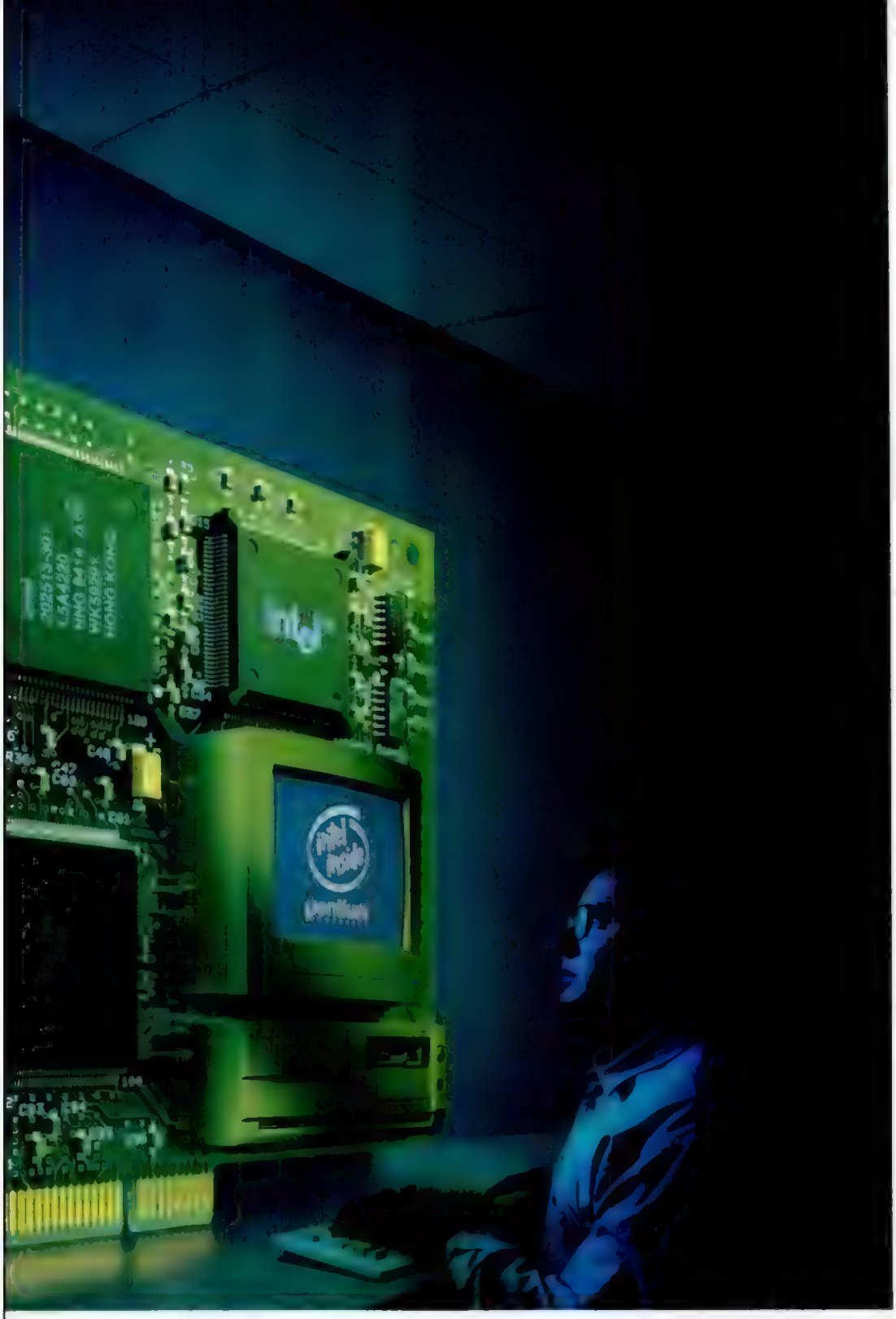

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Benchmark Tests: Network Operating Systems

While there is little question that IBM's OS/2 LAN Server Advanced 4.0 and Microsoft Windows NT Server 3.5 show significant performance improvements over previous versions, your actual improvement will vary depending on three factors: the type of disk striping employed, the disk geometry, and the fixes and tuning parameters used with the products. Still, even with these performance improvements, neither product had a stronger showing on our tests than NetWare 4.02.

With hardware striping, LAN Server managed a significant performance jump because it uses client-side caching, a technique that caches received network packets at the client. As traffic load increased, however, we found that LAN Server would drop network connections; we solved this by extending the NetBIOS time-outs. As for software striping, don't bother using it with LAN Server. Software striping performance was disappointing, primarily because it is not provided in OS/2 or LAN Server. Instead we had to run an IBM-recommended third-party application—Easy RAID—which is not as fast as running striping right from the kernel of the OS or NOS.

With hardware and software striping support, NT Server was a more consistent —albeit a poorer—performer. The key reason was the disk's geometry. In order to avoid file fragmentation, NT File System (NTFS) leaves 512K of disk space between each write. This results in poorer performance, because it is generally done on a disk's inner sectors, which on large drives are slower than the outer sectors.

With Microsoft's NTFS.SYS patch—available through many on-line services—NTFS writes over the old data without the 512K spaces. This increases performance (by 20 percent) on large drives, but also increases fragmentation. Another bug, which Microsoft plans to fix, was how NT Server treats the number of threads that it can process at one time. This bug caused the OS to be processor-bound under heavy I/O usage. In additional testing (not reported), we found that adding two processors boosted performance by only 30 percent. Even with two Pentium/66 processors, NT Server's network performance fell below that of both NetWare 3.12 and 4.02, and LAN Server 4.0. Indeed, with one CPU NetWare performs as well as NT Server does with two CPUs.

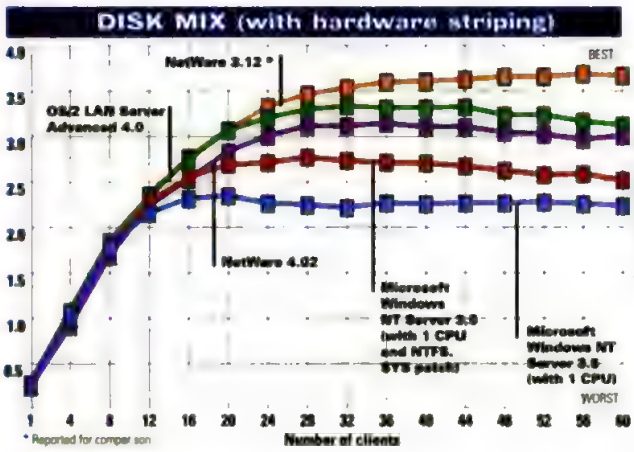
Finally, Microsoft also attributed NT Server's poor performance to our Compaq Smart Array/2 controller. Specifically, Compaq's Smart Start CD—a CD-ROM that automatically configures the server to the operating system—defaults the controller to writing 16K blocks of data to disk. But since NT Server writes data using 64K blocks, the controller spends time fragmenting blocks. As neither NetWare nor LAN Server defaults to writing data to disk using 64K blocks, they have less overhead and thus higher performance.

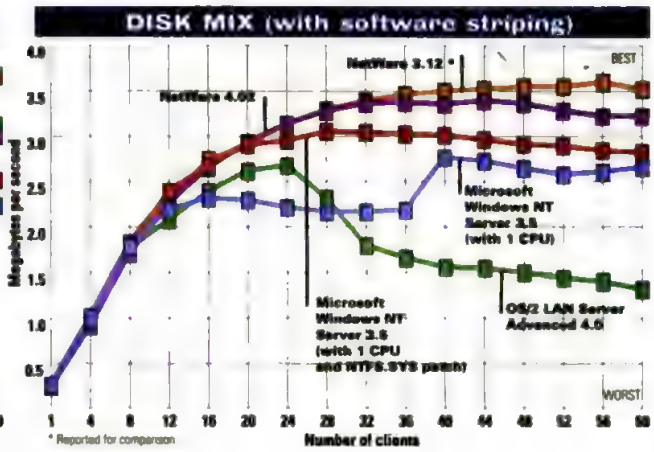
Test-Bed Configuration

* Each client included 8MB of RAM and a 33MB hard disk.

HOW WE TESTED

As the server on our test-bed, we used a Compaq ProLiant 4000 with a 66-MHz Pentium processor, 128MB of RAM, a 10GB hard disk, and four NetFlex-2 ENET-TR adapter cards. Our 60-node network consisted of four Ethernet segments, each of which included ten 486DX/33 PCs and five 386DX/33 PCs from various manufacturers. We tested under 16 load conditions, beginning with one client and then increasing to four. Thereafter, we added clients in increments of four, reaching a maximum load of 60 clients. We used the **Disk Mix** portion of NetBench 3.0, which presents application-level read and write requests through NetWare client software that runs on each workstation; the requests are then transported through the physical network to the server. The Disk Mix test was designed to tax the NOS I/O subsystem to measure the maximum possible throughput that the server can handle. We ran the test twice—once with hardware striping on the server and once with software striping on the server. Striping allows the NOS to increase volume size and improve overall disk performance by writing data across multiple spindles.





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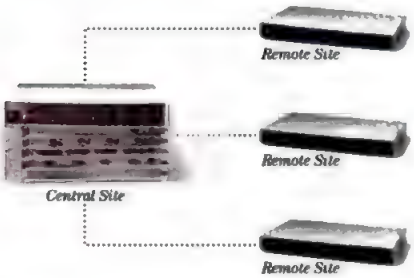

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NETWORK EDITION
EDITORS' CHOICE

Microsoft Corp.

• Microsoft Windows NT Server, Version 3.5

With Microsoft Windows NT Server, Version 3.5, Microsoft finally delivers an amazingly easy-to-install NOS with improved performance and powerful management tools, not to mention support for 32 processors. Still, it's not the fastest NOS around and has yet to offer the rich support for third-party management applications—something already provided for NetWare.

At the core of NT Server's GUI-based management utilities are User Manager, Disk Administrator, and Performance Manager. User Manager is an easy-to-use tool that allows you to add and delete individual users from the server, create groups, and grant access rights. (Unlike LAN Server, though, both NT Server and NetWare require you to use an archaic command line in order to create a large number of users or groups all at once.)

Disk Administrator offers users a simple and intuitive interface for managing disk space. You can create partitions, software-stripe multiple disk spindles, mirror drives, and format disks. Unlike NetWare, neither NT Server nor LAN Server offers the ability to create large mirror sets of striped partitions.

Performance Monitor, a tool unique to NT Server, allows the administrator to gauge the utilization of most server components such as CPU, RAM, hard disk, and NICs. NT Server also offers a utility that logs the usage of the server over time, helping you prepare for future upgrades. Of the other two reviewed products, only NetWare has a similar tool, Monitor. But Monitor isn't as comprehensive: It's a C-Worthy interface that monitors network resource usage.

SUITABILITY TO TASK	Microsoft Windows NT Server
Scalability	GOOD
Management	EXCELLENT
Installation	EXCELLENT

NT Server also offers other management tools not found in other reviewed products, such as the Dynamic Host Configuration Protocol (DHCP) and the Windows Internet Name Service (WINS). DHCP is an IP utility that dynamically manages IP addresses. WINS, which is similar to Unix's Directory Naming Services, assigns names to IP addresses.

When it comes to scalability, NT Server is impressive. With its symmetric multiprocessing, excellent driver support, and seamless integration into NetWare LANs, you would be hard-pressed to find a more scalable solution. While LAN Server also offers scalability via an optional package, OS/2 for SMP, Version 2.11, it doesn't match NT Server's impressive driver support and migration tools.

One of NT Server's strengths lies in its migration tools for NetWare integration. It currently offers two services that allow you to integrate NT Server within your NetWare LAN. The first lets you migrate the NetWare Bindery information, with the exception of passwords, to NT Server. The second is a gateway that lets NT Server users access NetWare services through an NT Server. Both tools offer an

▶ SUMMARY OF FEATURES

Network Operating Systems

Products listed in alphabetical order ■ = YES □ = NO	PC MAGAZINE NETWORK EDITION EDITORS' CHOICE Microsoft Windows NT Server 3.5	NetWare 4.02	OS/2 LAN Server Advanced 4.0
List price (100 users)	$3,348	$4,999	$6,795
Technical-support hours	24 hours, 7 days	24 hours, 7 days	24 hours, 7 days
Architecture			
Maximum amount of RAM supported	4GB	4GB	4GB
Minimum amount of RAM required	16MB	8MB	8MB
Maximum cache size	Unlimited	4GB	4GB
Maximum disk storage	408,000,000TB	32TB	64GB
Maximum number of users supported	Unlimited	1,000	16,000
Multiprocessor support	■	□	■
Maximum number of processors supported	32	N/A	16
Processor platforms supported:			
Alpha	■	Optional	□
Intel	■	■	■
MIPS	■	Optional	□
PA-RISC	□	□	■
PowerPC	□	Optional	■
Client Support			
DOS	■	■	■
Macintosh	■	■	■
OS/2	■	■	■
Unix	■	■	□
Windows	■	■	■
Network Security			
C2-level certification	■	□	□
Supports encrypted passwords	■	■	■
Network Directory Services			
Supports global directory services	■	■	■
Supports global naming services	■	■	■
Protocol Support			
Appletalk	■	■	■
IPX/SPX	■	■	■
NetBIOS	■	■	■
TCP/IP	■	■	■
Remote Access Services			
Remote access services included in package	■	□	□
Protocols supported	IP, IPX, NetBIOS, PPP, SLIP	AppleTalk, IP, IPX, NetBIOS (all optional)	IP, IPX, NetBIOS (all optional)
Supports ISDN	■	Optional	Optional
Supports X.25	■	Optional	Optional
Macintosh Support			
Macintosh support included in package	■	■	□
File and print services	■	■	Optional
Integrated management tools	□	□	Optional
Integrated user tools	■	■	Optional

N/A—Not applicable: The product does not have this feature.

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- Maximum configuration: 784 nodes, 16 hubs
- Available in 12-, 24-, and 48-port models
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- 185-meter hub separation capability
- Hot-swap capabilities
- 1960 RISC processor
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yes It runs with NetWare

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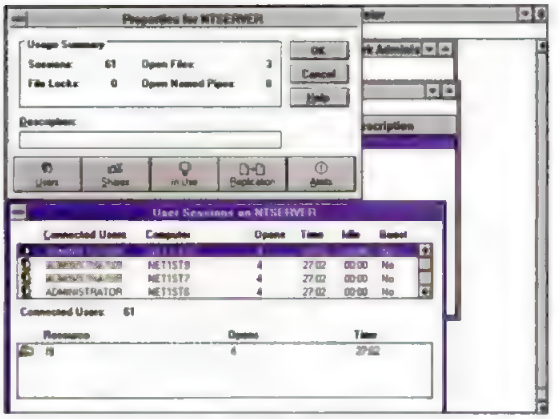
†In Canada call 1-800-387-3867, Dept. 8117. ††Based on U.S. list price of 8/1/94. ©1994 Hewlett-Packard Company RND008

effective means of easing the transition from NetWare to NT Server.

Installing a NOS has always been a task that requires network expertise—until now. NT Server's installation routine is the easiest we've seen to date, and it sets an example. When installing NT Server, the NOS actually autodetects all of your hardware devices, and it automatically configures each device. Amazingly, the product can even autodetect modems that are connected to your server. While both LAN Server and NetWare have improved their installation routines, neither comes close to the ease of NT Server's.



CONNECTED: Microsoft Windows NT Server's User Manager lets you add and delete users, create groups, and grant access rights.

Installing clients is also a breeze using a utility called Network Client Administrator. The utility creates a boot disk with enough software to connect the workstation to the server and copy the rest of the client software. We found this to be the easiest and most convenient way to set up workstations.

With its list of extensive features and ease of use, NT Server is an excellent choice for any environment. If, however, file performance is your sole criterion for choosing a NOS, you might want to consider either NetWare or LAN Server.

▶ **Microsoft Windows NT Server, Version 3.5.** List price: *For 100 users, $3,348.* Microsoft Corp., *One Microsoft Way, Redmond, WA 98052-6399; 800-426-9400, 206-882-8080; fax, 206-883-8101.*

Circle 958 on reader service card

Novell Inc.

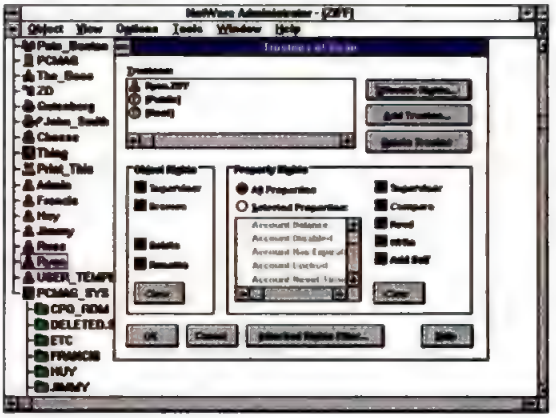
• NetWare 4.02

The newest version of NetWare—called simply NetWare 4.02—is the simplest to install yet, and offers more responsive management tools as well as fixes for 42 bugs found in NetWare 4.01. Yet even with all of these features, the product may leave you wanting more. Help is expected, but you'll have to wait until the arrival of NetWare 4.1.

One of NetWare's strengths has always been its management capabilities. Until now it has used a C-Worthy interface. With the NetWare 4.*x* family of products, Novell finally shipped a utility called NWAdmin that lets you manage your server via a graphical utility.

With the NetWare 4.x family of products, Novell finally shipped a graphical server-management utility.

NWAdmin allows you to centralize many of the tasks that were in the past done via SYSCON and PCONSOLE. In our testing, we found that adding and deleting users, setting up printers, and creating access rights have all become much easier.



CENTRAL CONTROL: NetWare's graphical utility, NWAdmin, performs management tasks previously done by SYSCON and PCONSOLE.

Other management tools include RCONSOLE, the best remote-management tool on the market today. With RCONSOLE, the administrator can control the server from any DOS client on the network and make changes such as loading and unloading drivers or adding new protocols. This feature is unique in the industry; no other product on the market offers such a flexible method of managing servers remotely.

Along with solid management features, NetWare is also a scalable solution. Even though NetWare does not currently support symmetric multiprocessing (SMP), it does support more clients more efficiently than LAN Server or NT Server. Novell realizes the importance of SMP and is planning to release an SMP version of NetWare in early 1995. NetWare does support asymmetric multiprocessing, which allows you to assign a process—such as an NLM—its own CPU. This solution, however, is not widely used, because it is targeted at users who run databases and need a lot of processing power for a single application.

The product also does an excellent job of managing your disk space. NetWare has on-the-fly compression for compressing all the files on the server, and it can essentially double the amount of disk space available to you. Surprisingly, we found in our testing that this compression has very little overhead and does not degrade the performance of your server.

While NetWare offers a great set of management tools along with a scalable design, the product is still difficult to implement in your current NetWare 3.*x* environment. The problem is that Novell does not provide a comprehensive set of migration tools. The only tool currently available is MIGRATE.EXE, which imports only NetWare Bindery information. For example, to migrate from NetWare 3.*x* to NetWare 4.02 and NetWare Directory Services, you will

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need to upgrade all of your client drivers to the latest VLM client drivers. For a site with thousands of nodes, this is a tremendous undertaking. NetWare 4.02 does offer a Bindery Emulation mode that allows non-VLM clients to connect to server resources, but this solution is also difficult to manage. Novell has promised better migration tools with NetWare 4.1.

SUITABILITY TO TASK	NetWare
Scalability	GOOD
Management	GOOD
Installation	AVERAGE

NetWare 4.02 offers impressive management capabilities and a much-improved installation routine. But you should consider the difficulties associated with migrating from NetWare 3.*x* environments. If you're thinking of moving to NetWare 4.*x*, we suggest you wait for release 4.1.

▶ **NetWare 4.02.** List price: *For 100 users, $4,999.* Novell Inc., *122 E. 1700 South, Provo, UT 84606; 800-453-1267, fax, 801-429-5775.*

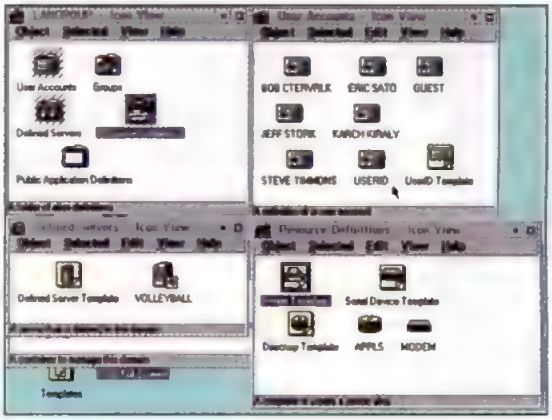
Circle 959 on reader service card

IBM Corp.

• OS/2 LAN Server Advanced, Version 4.0

OS/2 LAN Server has been around for some years, but its acceptance has been slow. This was due in part to its text-based, unintuitive management and limited driver support. With OS/2 LAN Server Advanced, Version 4.0, IBM has finally addressed many of these problems. New management tools and improved driver support should help promote LAN Server as a legitimate competitor in the NOS market.

While the core of the NOS has not changed much since Version 3.0, IBM has focused most of its energy on improving LAN Server's driver support and ease of use. This has been accomplished by adding a new, simplified installation routine and a set of GUI-based management tools, making the product a snap to install and administer. Version 4.0 supports an extensive number of network and SCSI adapters. While the list of drivers is still not as extensive as those offered by NT Server and NetWare, it's become much better.



SIMPLE SETUP: OS/2 LAN Server Advanced's new GUI-based management tools make the product easy to install and administer.

We found the new version much easier to use than Version 3.0. The new management tools easily allow you to create users, set up printers, and tune the performance of your server. Setting up users has finally become a drag-and-drop affair, a far cry from the archaic user interface of Version 3.0. Setting up groups of users at one time is also pretty easy, unlike with NT Server and NetWare. Tuning the server is also improved, but it's still a far cry from perfect. A new tuning utility lets you customize the server, thereby eliminating the cumbersome task of adjusting hundreds of possible parameters in OS/2 and LAN Server. Unfortunately, in our testing we found that we still had to change parameters manually in LAN Server's configuration files in order to tune the product for our benchmark tests.

SUITABILITY TO TASK	OS/2 LAN Server Advanced
Scalability	GOOD
Management	GOOD
Installation	GOOD

LAN Server has always been a scalable solution, with excellent file performance and broad application support. With the addition of symmetric multiprocessing (SMP), LAN Server 4.0 is scalable for almost any size environment. SMP

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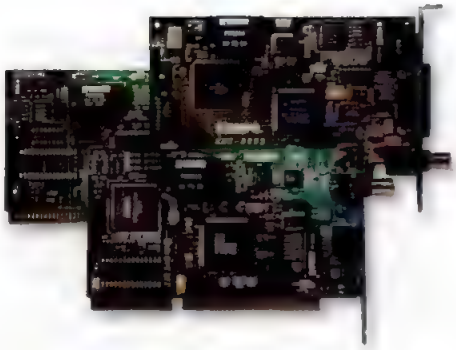

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CIRCLE 905 ON READER SERVICE CARD

support is available via a separate product, OS/2 for SMP, Version 2.11. Unlike NT Server, LAN Server does not include a set of migration tools for NetWare. This makes the product unattractive for multiserver NetWare shops, since it makes the transition very difficult. Fortunately, LAN Server offers a gateway, OS/2 Requester for NetWare, that lets you share NetWare resources from LAN Server clients. This is done by redirecting NetWare drives on the server and sharing those drives as a LAN Server resource. This is similar to NT Server's software gateway, but slightly more difficult to use.

IBM does offer an excellent transition for current LAN Server users who are looking to upgrade. Unlike NetWare 4.02, which requires a complete overhaul of your environment, LAN Server 4.0 allows you to install the server and client software on a few or all of your servers, since the software is backward-compatible.

Along with enhanced management tools, LAN Server also offers an intuitive and unobtrusive installation routine. Installing the product proved to be a breeze. The new installation routine autodetects your NICs and automatically configures them via a new utility called Multi-Protocol Transport Services (MPTS). MPTS is similar to the network configuration utility used in LAN Server 3.0, LAN Adapter Protocol Support, but it's a lot easier to use.

IBM has made great strides with the release of OS/2 LAN Server Advanced 4.0. The product finally sports an intuitive installation routine along with easy-to-use administrative tools that make management a breeze. This version, however, is still hampered by minor shortcomings, such as its lack of exhaustive driver support and certain installation problems associated with OS/2.

▶ **OS/2 LAN Server Advanced, Version 4.0.** List price: *For 100 users, $6,795.* IBM Corp., *Old Orchard Rd., Armonk, NY 10504; 800-426-2968; fax, 914-765-1900.*

Circle 960 on reader service card

OUR CONTRIBUTORS: O. Ryan Tabibian is a technical analyst and Robert P. Lipschutz is a project leader for *PC Magazine* Network Edition. Additional testing was done by Russ Iwanchuk, a technical support specialist, and Huy Nguyen, a senior technical specialist, at ZD Labs.

▶ HAND-HELD NETWORK TESTER

Compas Guides the Way to Easy Network Testing

BY STEVE RIGNEY

Forget all those complicated network testing tools. With Microtest's Compas ($4,995), you get an Ethernet cable scanner, a protocol analyzer, and a NetWare monitoring utility wrapped in a single easy-to-use solution.

NETWORK GAMEBOY: The Compas provides a wide range of easy-to-use testing features.

Typically, network test equipment is difficult to use and falls into one of two categories: cable scanners and portable network diagnostic tools. Cable scanners test network cable for bad connections or line noise. One of the best examples is Microtest's own PentaScanner ($3,995; for more information, see Network Edition, First Looks, February 8, 1994). Portable network diagnostic tools perform protocol and network-traffic analysis. These products include such units as Network General Corp.'s Portable Sniffer and the Fluke 675 Combo LANMeter ($8,995; for more information, see Network Edition, First Looks, June 14, 1994). The Compas bridges the gap between these two categories, offering the best features of both.

The Compas, which is a small hand-held device much like the PentaScanner, has a tiny, backlit display that provides easy-to-read access to all of Compas's test results and help menus.

You launch the Compas's myriad tests from one of the unit's function keys. You'll probably appreciate the Diagnose button most of all: When pushed, it produces such easy-to-understand menu choices as "Are Servers OK?" and "Why is Network Slow?".

For example, we connected the Compas to a two-server, two-segment NetWare 3.12 Ethernet network and selected "Are Servers OK?". The Compas tested our

▶ SUMMARY OF FEATURES

Hand-Held Network Testers

Products listed in alphabetical order ■ - YES □ - NO	Fluke 675 Combo LANMeter	Microtest Compas	Microtest PentaScanner
List price	$8,995	$4,995	$3,995
Ethernet/Token-Ring	■■	■□	■□
Context-sensitive help	■	■	■
Suggests solutions for common problems	□	■	□
Bidirectional testing	□	■	□
Protocol analysis	■	■	□
Wire mapping	■	■	■
Frame-type recognition	■	■	□
Network server emulation	□	■	
Traffic statistics and history	■	■*	□
Traffic generation	■	□	□
Performs diagnostic tests on			
10BaseT cable and connectors	□	■	■
NetWare-specific settings	□	■	□
Serial connections		■	

* The Microtest Compas maintains historical data for up to 24 hours only.

network cable, found all of the NetWare servers on our network, and gathered statistics on the servers. The unit then listed all the problems it encountered and offered solutions for some of the more common errors. All this took a grand total of two minutes.

One of Compas's unique features is a pass-through option called NetTap, which enables the unit to connect *between* a server and hub. This allows the Compas to monitor both ends of the connection and determine why the network is slow or why users can't log on. Every other tester on the market attaches only to one end of a connection, and so cannot simultaneously monitor both ends of that connection.

Another of the Compas's unique features is its ability to test asynchronous serial connections. This is useful for checking to see if modems, remote access servers, and serial printers are communicating properly.

Additionally, you can use the Compas to list all network client PCs, the Ethernet frame types traversing your LAN (such as 802.3 Ethernet or Ethernet SNAP), and the protocols (TCP/IP and IPX) being used. By using the included NetWare utility, Compas NLM, we were able to monitor a variety of NetWare-specific information, such as user connections, server cache buffers, and CPU utilization. The Compas even notified us that one of our file servers had too many cache buffers allocated and recommended a fix.

In addition to the standard diagnostic functions, you can use the Compas to provide a wire map of your 10BaseT cable in order to see a diagram of the individual wire connections. Compas also measures near-end cross talk (NEXT), which is noise on the cable caused by external interference. Other tests include those for line impedance, resistance, and cable shorts. We even used the Compas to see which nodes on our network were generating the most traffic.

Unlike the PentaScanner, which saved the results of up to 500 tests, the Compas cannot save test results for historical analysis. You can, however, print these results or save them to disk. Alternatively, you can set up the Compas to monitor a particular network component for up to 24 hours and view the history of that period. Unfortunately, these results are lost if you cancel the test or turn off the unit.

All in all, the Compas is a well-rounded, easy-to-use network testing tool. Although some users may think the unit expensive, we suspect that many will be attracted by the Compas's broad range of tests and ease of use.

▶ **Compas.** List price: *$4,995.* Microtest Inc. *4747 N. 22nd St., Phoenix, AZ 85016; 602-952-6400; fax, 602-952-6401.*

Circle 954 on reader service card

▪ As Simple as A-B-C

```
1/5        Diagnose
1. Are Servers OK?
2. Why is Network Slow?
3. Why Can't I Log In?
4. Why Does Connect Drop?
5. Is This Cable OK?
SELECT
```

Testing with the Compas is easy. Just pick one of the menu options . . .

. . . and watch as the unit runs a series of tests on network devices and cabling . . .

Are Servers OK?	
TESTING	RESULT
For Cable...	PASS
Server...	PASS
PHOENIX	WARNING
DYNAMO	PASS

Are Servers OK?	
TEST	RESULT
PHOENIX	
Redir Dsk Blk	HIGH
Pkt Rx Bufs	MARGINAL
Dirty Cch Buf	HIGH

. . . and gives you the results.

▶ PRINTER ADMINISTRATION

Conserve Printer Power to Save Money

BY TONY POMPILI

Digital Products' new NetPrint PowerMinder ($169) may cut up to $200 per printer off your annual electric bill. This add-on for the vendor's NetPrint print servers turns off idle printers to minimize expense.

The PowerMinder is a small box that resembles a surge protector. It plugs into any 110V power outlet and attaches to the NetPrint via an included twisted-pair cable. Each PowerMinder can control only one printer, but you can attach two PowerMinders to any NetPrint. Installation was very easy; it took us a scant 10 minutes to set up the PowerMinder on our NetWare 3.12 network.

MONEY SAVER: The NetPrint PowerMinder regulates printer power consumption and can save you lots of money on your energy bill.

The PowerMinder comes with NSDoctor, Windows-based control software that allows you to select the amount of time a printer can sit idle before it shuts down. PowerMinder will activate the printers again as soon as it receives a print job. Once you load and run the software (from any network client), you can shut the application down.

The PowerMinder worked as promised. Of course, it may prove unnecessary for newer printers, such as the HP LaserJet 4M Plus, which include built-in power-saver modes.

Simple setup and potential savings make the PowerMinder a valuable product, but remember that it only works with the NetPrint print servers.

▶ **NetPrint PowerMinder.** List price: *$169.* Digital Products Inc., *411 Waverley Oaks Rd., Waltham, MA 02154; 800-243-2333, 617-647-1234.*

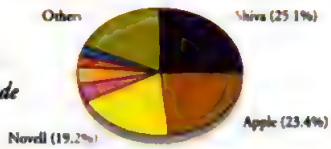
Circle 957 on reader service card

REMOTE ACCESS IS NOT A TOUGH CALL.

1 "When I travel, I dial into a Shiva LanRover on an 800 number (so I don't need to go through a credit card), and that's my world view of remote access..." *Stewart Alsop, Editor-in-Chief,* InfoWorld, *May 16, 1994, p.102.*

INFO WORLD

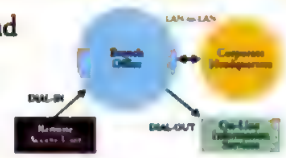
2 More companies call on Shiva for remote access solutions than any other. *International Data Corporation, "1993 Worldwide PC LAN Remote Access Server Vendor Market Share."*



3 PC Magazine says "Shiva knows remote access," and calls LanRover/E a "...compact, clean package that works well for remote user and network manager alike." PC Magazine, *August 1994, p.317.**

PC MAGAZINE EDITORS' CHOICE

4 Only Shiva offers dial-in, dial-out, and dial-up LAN-to-LAN for PC, Mac and UNIX. All in one box. It's the new LanRover 3.0.



5 "Apple, IBM, and Microsoft have all established strategic partnerships with Shiva to integrate remote access into their products. With these partners, Shiva must be doing something right." *David Strom, David Strom Inc.*

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*PC Magazine, June 1994. †Offer limited to one per customer per situation. Offer expires 11/15/95 or while supplies last. © 1994 ARTISOFT INC. Eagle Technology is a business unit of Artisoft Inc. The Eagle Technology mark is a registered trademark of Artisoft Inc. Novell and NetWare are registered trademarks and NE3200, NE3210 and NE2000plus are trademarks of Novell Inc. PC Magazine is a registered trademark of Ziff-Davis Publishing Co.

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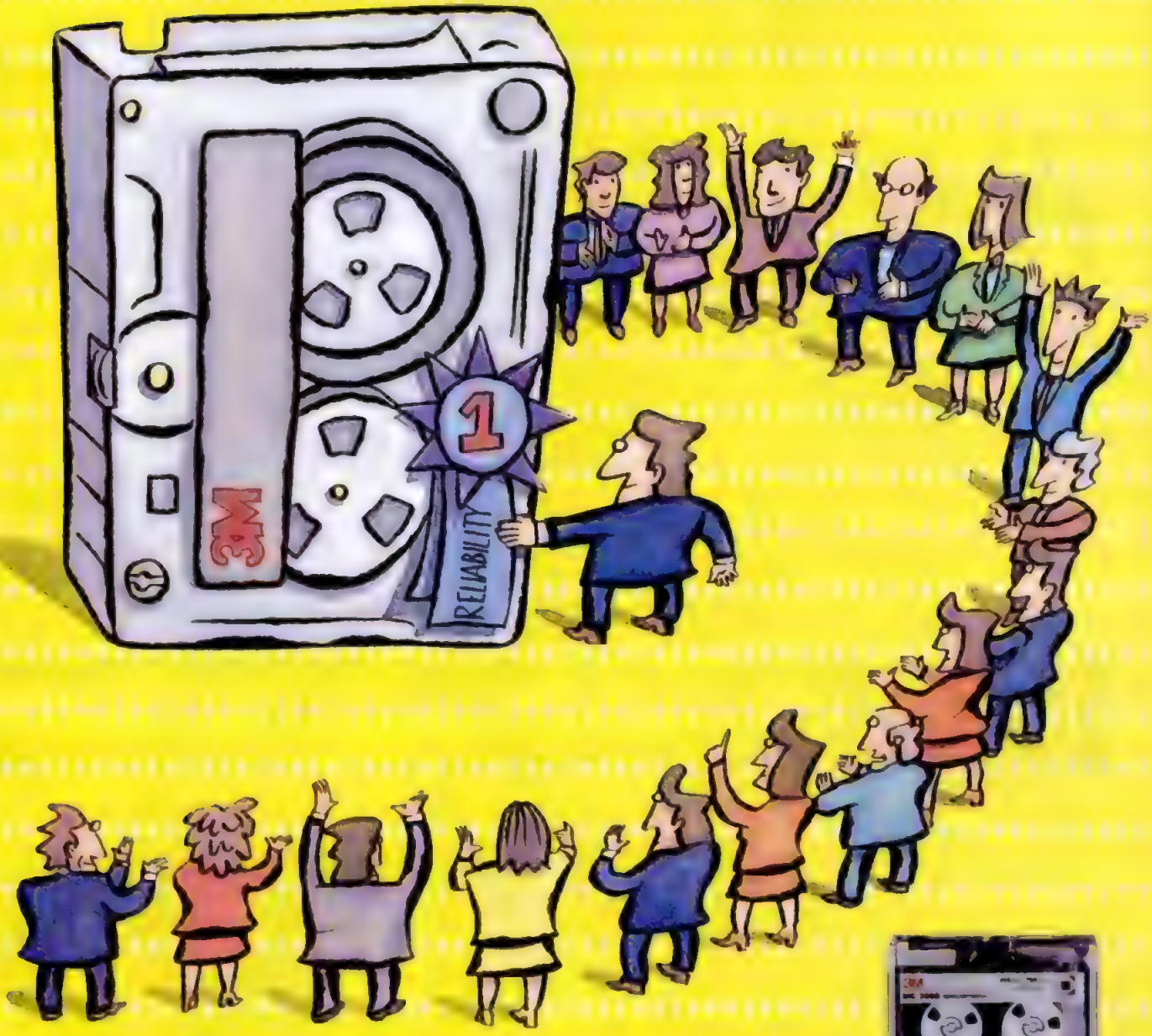

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CIRCLE 910 ON READER SERVICE CARD

▶ TCP/IP STACK

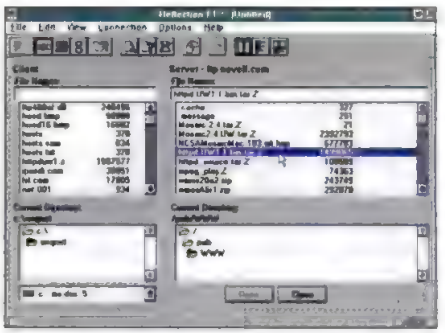
No Frills Internetworking from WRQ

BY PADRAIC BOYLE

With so many TCP/IP stacks on the market, how do you find the one with the most added value? While most vendors elect to differentiate their products by including extra utilities (such as e-mail or a World-Wide Web browser), Walker Richer & Quinn (WRQ) chose to set apart their product, TCP Connection, with a unique architecture.

TCP Connection ($249) is a Microsoft Windows–based, 32-bit TCP/IP stack that supports direct network connections as well as dial-up Serial Line Internet Protocol (SLIP) or Point-to-Point Protocol (PPP) connections. This low-cost, easy-to-use package offers a wide variety of basic communications tools, such as FTP, telnet, and terminal emulation; speaking generally, it is a strong choice for most basic TCP/IP applications.

The code for most TCP/IP stacks is based either on TSR (terminate and stay resident) programs, dynamic link libraries (DLLs), or virtual device drivers (VxDs); TCP Connection is the only product on the market that utilizes a combination of DLLs and VxDs. According to the vendor, this unique approach takes advantage of the speed of VxDs and the reliability of DLL drivers. Though we agree that the product is both fast and reliable, it didn't seem any more so than Frontier Technologies Corp.'s SuperTCP/NFS for Windows or Spry's AIR NFS.



DRAG AND TRANSFER: TCP Connection provides an easy-to-use FTP client.

Installing TCP Connection was easy: We just entered all of our TCP/IP information and the brand of network adapter we were using. The installation routine automatically detects whether you are using an ODI- or NDIS-compliant network driver for LAN-based TCP/IP connections or a serial port for SLIP or PPP connections.

In addition to telnet and FTP, TCP Connection includes a set of packet-tracing and statistics-monitoring utilities. These are helpful for diagnosing problems and analyzing the overall health of the TCP/IP network. All errors are recorded in a log that provides the time, date, and source of the error.

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TCP/IP Applications for Windows

Includes WinSock TCP/IP

100% DLL

Only 6KB Base Memory

5 Minute Install

Internet Communications: Office, Home, Remote

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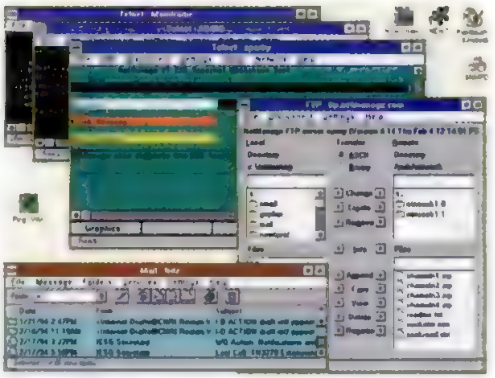
APPLICATIONS Telnet (VT100, VT220, TVI), TN3270, TN5250, FTP (client & server), NFS (client & server), SMTP Mail with MIME, NewsReader, PROFS Mail, LPR/LPD, Gopher, Phonetag, Ping, Finger, BIND, Whois, Scripting, Statistics, Custom, TFTP, SNMP Agent, and more.

TERMINAL EMULATION Advanced features include scalable fonts, scripting, button pad, screen capture, drag-and-drop keyboard remapping and printing. **INTERNET ACCESS** Easy point-and-click access to the resources of the Internet. Read and post to news groups, download software or documents and search gopher space. **NFS** First ever client and server for Windows provides transparent file and printer sharing (ask for Chameleon*NFS*). **MAIL** Internet SMTP Mail with folders, rules and MIME multi-media attachments. **DEVELOPER TOOLS** Windows Sockets API; ONC RPC/XDR; WinSNMP, FTP, SMTP APIs, Visual Basic support and more.



Data Comm MAGAZINE TESTER'S CHOICE

May 1993

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CIRCLE 894 ON READER SERVICE CARD

TCP Connection even offers possible solutions.

Also, TCP Connection comes with FTP client and server applications. The Windows-based FTP client makes file transfers easy with a drag-and-drop interface, similar to the Network File Manager in AIR NFS (Editors' Choice for "Tools for Connecting" in our "Making the Internet Connection" story, October 11, 1994). You can switch to an FTP command line or open both interfaces at the same time to view the command-line equivalents of your mouse-controlled FTP commands. The FTP server lets you make files on your PC available to other users. The security features are excellent, allowing you to restrict access via address filtering and password protection.

Unlike some of its more expensive competitors (SuperTCP/NFS is $495; AIR NFS, $449), TCP Connection lacks some of the more popular Internet access tools, such as Gopher, e-mail, or a newsgroup reader. Without these, TCP Connection will not challenge the Spry or Frontier products as an all-in-one TCP/IP solution. Instead, WRQ hopes to position TCP Connection as the TCP/IP stack over which third-party applications run in corporate-wide installations.

That could pose problems for TCP Connection, as competition in the TCP/IP world is fierce right now, and most TCP/IP stacks include all the TCP/IP utilities one would ever need. Based strictly on features, both SuperTCP/NFS and AIR NFS rise head and shoulders above TCP Connection. The feature set will improve somewhat during the first quarter of 1995 when WRQ releases an integrated TCP/IP package for $399 that will include both TCP Connection and Reflection 2 for Windows, the vendor's terminal-emulation application.

TCP Connection is an affordable solution for corporate-wide TCP/IP installations. But the lack of Internet applications may turn users away from the product toward other, more complete packages.

▶ **TCP Connection.** List price: *$249.* **Reflection 2.** List price: *$299.* Walker Richer & Quinn Inc.; *1500 Dexter Ave. North, Seattle, WA 98109; 206-217-7100; fax, 206-217-0293.*

Circle 964 on reader service card

▶ SUMMARY OF FEATURES

TCP/IP Stacks

Products listed in alphabetical order	AIR NFS	SuperTCP/NFS for Windows	TCP Connection
List price	$449	$495	$249
TCP/IP implementation	DLL	VxD	DLL/VxD
Connections supported	Direct, SLIP, PPP	Direct, SLIP, PPP	Direct, SLIP, PPP
TCP/IP applications included	FTP, telnet	Fax, FTP, NFS, telnet, TFTP	FTP, telnet
TCP/IP utilities included	Finger, PING, Whois	Finger, PING, Whois	Finger, PING
Internet applications included	Gopher, mail, Mosaic, news	Mail, news	None
Server applications included	FTP	Fax, FTP, mail, NFS	FTP
Terminals emulated	NetWare virtual Terminal, TN3270, VT52, VT100, VT200	TN3270, TTY, VT320	None

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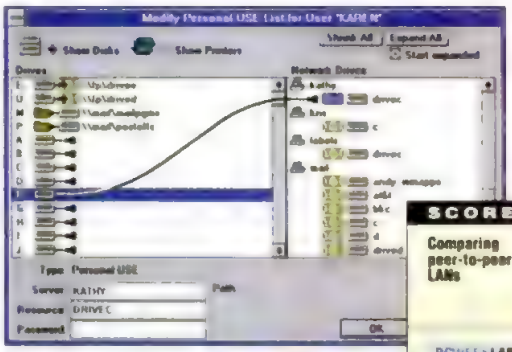

Now connecting resources is plug and play—literally!

"POWERLan's combination of ease of use, solid performance, and strong management features will appeal to many small to medium-sized sites looking to connect their stand-alone computers."

PC Week
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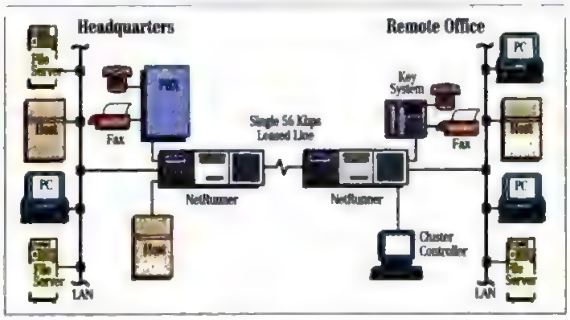

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CIRCLE 944 ON READER SERVICE CARD

Network Edition

NEW & IMPROVED

News of announced network products and upgrades

By Vicki B. Jacobson

NEW

AT&T Points You in the Right Direction

"Roam free" seems to be the catch phrase for users of **AT&T Wireless Communications and Networking Division**'s WaveAround. Designed for the company's WaveLAN PCMCIA and WavePoint wireless products, WaveAround permits mobile users to move freely about a building without losing their wireless connections. Users have uninterrupted access to the network as WaveAround scans for the best frequency available emanating from a WavePoint (a wireless access point on the WaveLAN network). Moving freely within the WavePoint's range, users can continue to send and receive data as they roam about. WaveAround also provides automatic recovery should the user go out of range.

To ensure the best possible coverage, WaveAround features a wireless LAN installation tool: WaveMonitor. WaveMonitor is a graphical-based application that helps even the nontechnical user install and operate the access points.

▶ **WaveAround.** List price: *Included with WaveLAN PCMCIA and WavePoint products.* AT&T Wireless Communications and Networking Division, *1700 S. Patterson Blvd., Dayton, OH 45479-0001; 800-225-5627.*

Circle 951 on reader service card

NEW

Cabletron Hubs Get Token-Ring Touch-Up

Cabletron Systems maintains compatibility with existing modules while announcing 18 new Token-Ring products for its Multi Media Access Center (MMAC) and MMAC-Plus hubs. The new products provide a variety of functions ranging from port switching to integrated bridging, routing, and switching.

TOKEN TOWER: Cabletron adds 18 new Token-Ring modules to its MMAC and MMAC-Plus hubs.

These products break into three classes: Token Ring Port Assignment Modules, Token Ring Dual Repeater Media Interface Modules, and Token Ring Multichannel Modules. The Port Assignment Module provides port switching with support for up to four rings on the hub's bus, as well as two additional auxiliary rings. The Repeater Module provides access to multiple backplane rings and port switching. SNMP management is available for two or four rings with the Management Modules.

▶ **Token Ring Port Assignment Modules.** List price: *$2,795 to $4,295.* **Token Ring Dual Repeater Media Interface Modules.** List price: *$5,295.* **Token Ring Multichannel Management Modules.** List price: *$8,250 to $10,995.* Cabletron Systems Inc., *35 Industrial Way, Rochester, NH 03867-0505; 603-332-9400.*

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HOT PROSPECT

cc:Mail Takes on a New View for Managers

Managing your e-mail system just got easier with **Lotus Development Corp.**'s Lotus cc:Mail View. It provides a graphical display of the cc:Mail network, including message status, alerts, and reports.

MailMap, the package's graphical topology manager, details messaging system components. It organizes these components by status, by object type, or geographically. MailMap displays message routing, and it includes an autodiscovery feature that identifies components and changes within directories and draws the corresponding topology maps.

Also included is MailAlert, a warning system for administrators that identifies potential errors such as failed connections or message delivery. In addition, cc:Mail View includes Lotus Approach, a relational database that facilitates predefined reports of such areas as connection information, mailbox usage, and message-queue statistics.

▶ **Lotus cc:Mail View.** List price: *$2,995.* Lotus Development Corp., *800 El Camino Real West, Mountain View, CA 94040; 415-335-6400.*

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NEW

Wildfire Spreads Mobile Communication

Staying connected while you're out on the road takes on a whole new meaning with **Wildfire Communications**' telephone-based electronic assistant. The Wildfire Electronic Assistant is a voice-activated communications system that handles incoming and outgoing calls, schedules follow-up calls, gives reminders, and maintains a contact list. Because this is a multitasking system, it can screen calls and deliver this information to the user while another caller is on the line. The system is installed at the office and connected to a public telephone network via a T1 link. Users can dial in from any phone—cellular or coin-operated. Future versions will support fax and e-mail.

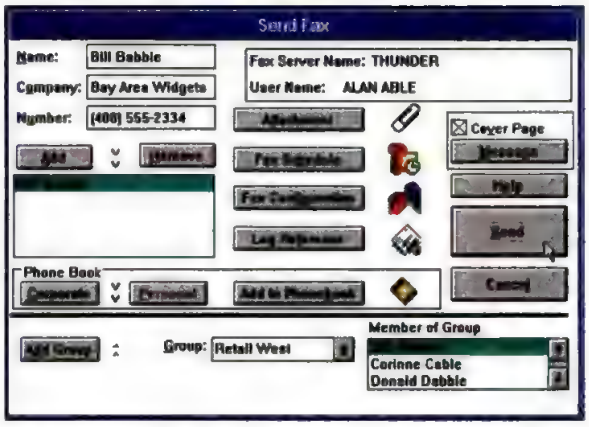
▶ **Wildfire Electronic Assistant.** List price: *$2,000.* Wildfire Communications, *20 Maguire Rd., Lexington, MA 02173; 617-674-1500; fax, 617-674-1501.*

Circle 961 on reader service card

IMPROVED

Castelle Eases Network Faxing

Managing, sending, and receiving faxes on a NetWare network just got easier with the latest release of **Castelle**'s fax-server software. FaxPress, Version 3.5, provides an express installation option for automatic setup or a customized installation routine for network managers who want more control. Version 3.5 incorporates in one box all the control buttons for sending faxes. With an attachment option, users can scan documents into the software to be sent as fax attachments. For receiving, FaxPress supports CCITT subaddressing to route incoming faxes, in addition to its previous support for manual routing and automatic routing (DID and DTMF). Optical Character Recognition software is also available as an option.



BOX OF BASICS: FaxPress organizes all of its controls for sending a fax in one box.

▶ **FaxPress, Version 3.5.** List price: *For users of 3.x or above, $395.* Castelle Inc., *3255-3 Scott Blvd., Santa Clara, CA 95054; 800-289-7555.*

Circle 962 on reader service card

NEW

StationLock Promises to Secure Your LAN

Trend Micro Devices combines network security and virus protection in the software version of StationLock for LAN. StationLock integrates a preboot DOS platform on the client with an NLM on the server. Network managers can control access privileges by configuring each client's security settings from the server. Settings can be established that allow a single client to be operated by multiple users or for a single user to access multiple clients. Additional security features include password protection, floppy disk encryption control, and restricted floppy disk drive, directory, and file access. Antivirus features include a preboot virus check and virus pattern scanner.

▶ **StationLock for LAN.** List price: *$129 per client; free as an NLM.* Trend Micro Devices Inc., *2421 W. 205th St., Suite D-100, Torrance, CA 90501; 310-782-8190.*

Circle 963 on reader service card

BRIEFS

STORAGE

Maxoptix Corp.'s NWorks division offers Praxis, a plug-and-play network storage device. The Praxis system ($49,995) installs directly onto the Ethernet network and creates 60GB of LAN on-line storage. Praxis is platform- and NOS-independent. It does not require special drivers or physical mounting on the server or clients: Both recognize it as another server on the network. 408-954-9700.

CORE International scales down mass storage with its COREarray Micro 2000 subsystem. COREarray ($7,999) provides scalable storage from 1GB to 2GB; network managers can add additional drives as the network grows. The system features RAID 3 and 5 fault tolerance, remote monitoring, and alarms. 407-997-6055.

MODEMS

Apex Data delivers a combined fax modem and Ethernet card with the MultiCard ($549). The Type II PCMCIA card can handle concurrent operation and multitasking capabilities. Remote users can remain logged on to a network while sending and receiving data files or faxes. MultiCard supports 10BaseT and 10Base2 wiring for DOS, Windows, NetWare, and OS/2 environments. 510-416-5656.

Linksys's new PCMCIA Faxmodem 14.4/14.4 provides users with a 14.4 kilobit-per-second fax and modem and MNP 10 error correction, for high-speed cellular transmission. The Faxmodem ($299) offers data and fax transmission speeds up to 57.6 Kbps with V.42 compression. It is bundled with Delrina's COMit and DOSFax programs, allowing users to send and receive faxes, to access the Internet, and to dial-in to popular on-line services. 714-261-1288.

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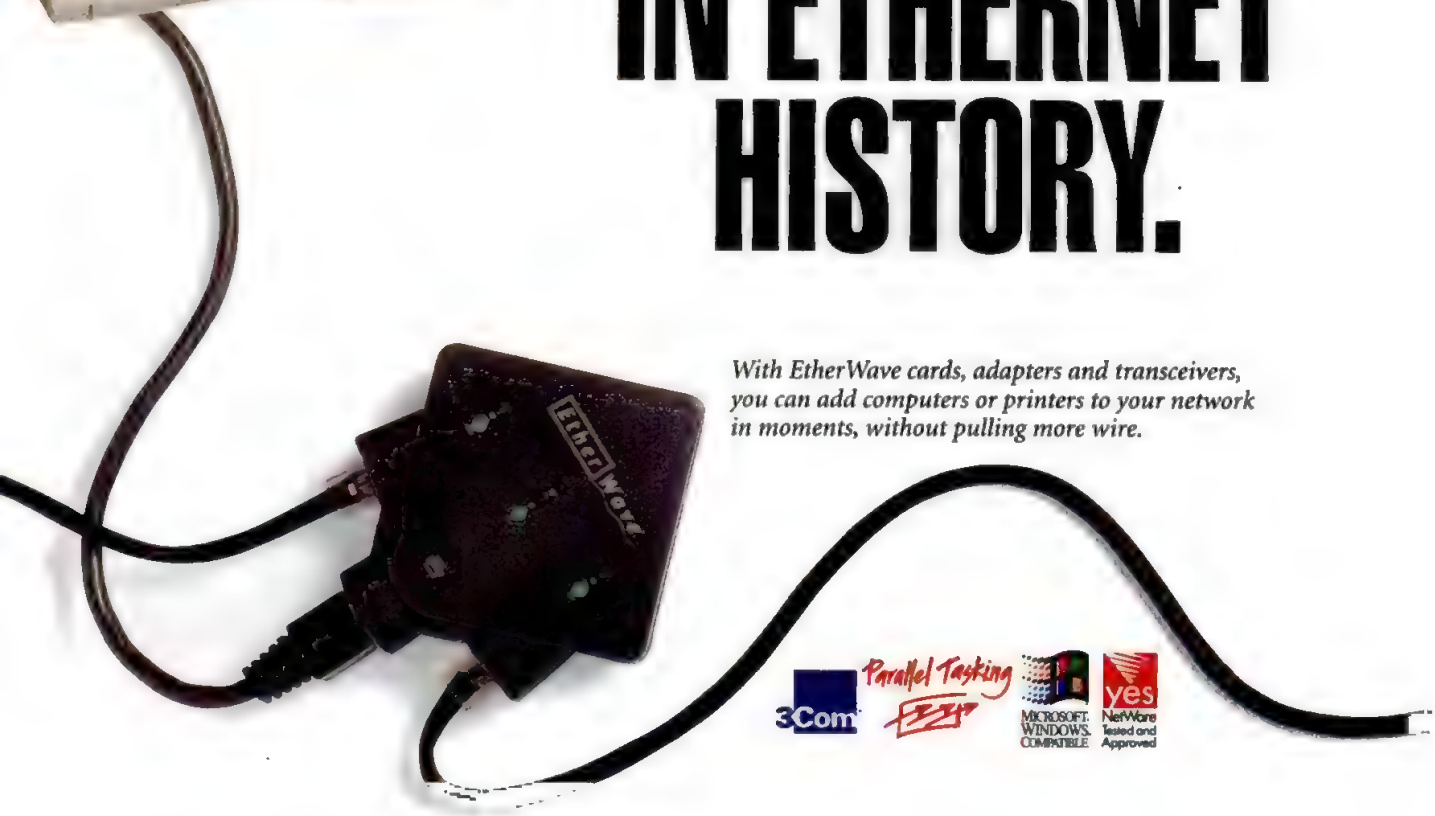

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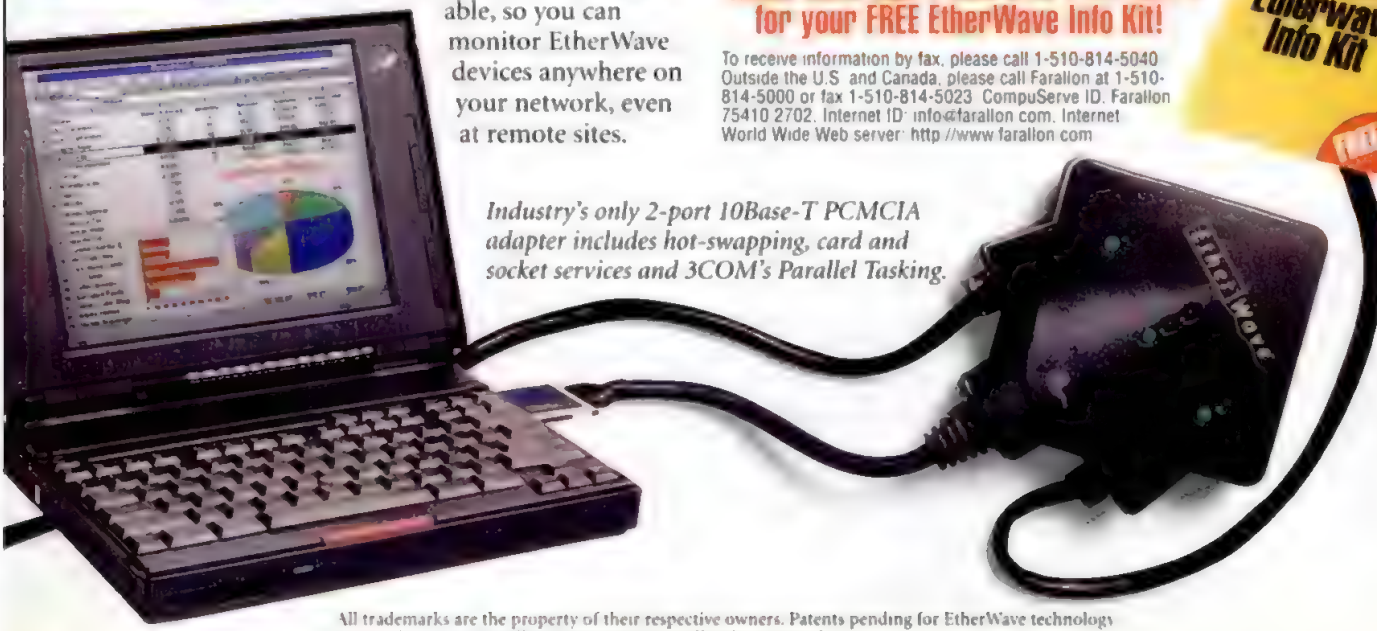

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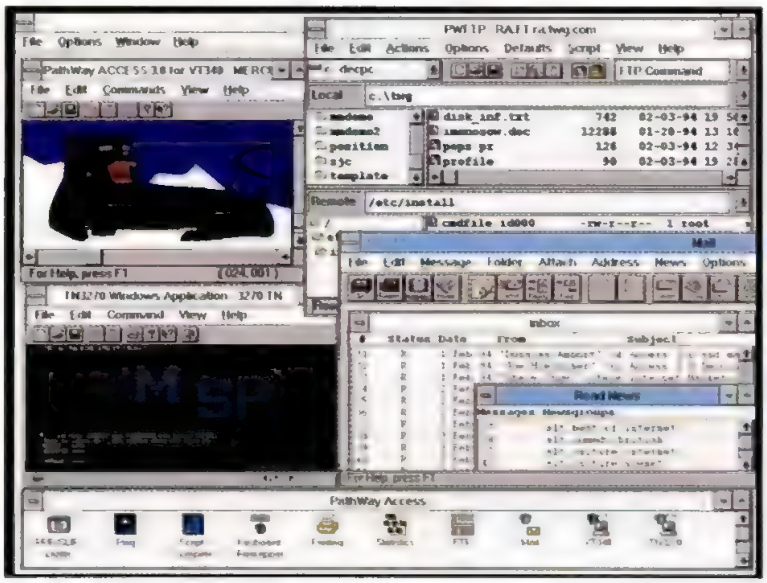

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CIRCLE 864 ON READER SERVICE CARD

Lessons from the Installation Trenches

By Diane Danielle

The ordinary user may have to put up with bad installation programs just a couple of times a year, but the average network manager or consultant may be faced with such problems weekly or daily.

Some things installation programs do, or don't do, aren't so much detrimental to good network management as just annoying. Would it be all that difficult for the industry to agree on a standard name for the installation program? I could live with INSTALL.EXE and SETUP.EXE., but the variations really bug me.

I am tired, too, of installation programs that automatically scan my C: drive for Windows. I have a couple of local drives on one machine so Windows could be on another drive, and I usually don't store Windows on any local drive; I store it on my server. The process is thus useless and time-consuming. Why not simply ask me where Windows is installed?

Usually these are the same programs that copy a bunch of files to the local drive to run the installation program. That's even more irritating, because sometimes I don't have a local drive and when I do, it often lacks free space. I've got no problem with the installation program's need for some disk space; I'd just like the program to ask me which drive it should use.

Some programs still mess with my AUTOEXEC.BAT and CONFIG.SYS files, and the ones that don't aren't much smarter. They'll make a backup, but if you have to run the installation more than once, they're not smart enough to make multiple backup copies. Sometimes, when the vendor is nice enough to create separate modified versions of these files, the new versions turn up in my application directory or in the root of my server drive. Would it be that difficult to ask me what to name the modified files and where to put them?

While they're at it, I'd like all installation programs to do what some of the better ones do: Let me browse drives during the installation process to select where to put the application. I know I should figure that out before I start the installation, but when you work on many different systems, it's easy to forget where you are and what directory you should use on the current system.

But this assumes you get a choice in the first place. Lots of applications, both end user and network oriented, still insist on being installed in a particular directory in the root. When I ask developers why they do this, they answer that a standard application directory is easier to support. (I suppose we should just be grateful that they put the files in a directory.) I've no objection to a vendor offering a default, but my directory structure is mine and I want to put software where I want it, not where the vendor decides it should go.

The biggest headache these days is the sheer number of floppy disks. When an installation fails, you have to go through the long, boring process all over again. Surely programs of this size, whether they are shipped on disks or CD-ROMs, should be designed with restart functions.

Windows, far from making application installations easier (as some Microsoft folk contend), has exchanged one set of problems (driver installation by application) for another. The Windows situation has gotten so bad, a cottage industry has grown up just to track and manage the changes Windows applications make to the environment. But these programs can only identify what is happening; the underlying problems remain.

The DLL updates are a particularly sore point with me. I'd like installation programs to warn me if they're going to update files in the Windows system directory (if only so I can change them from read-only to writable before I begin the installation); give me comparative information (filename, size, and date); and let me choose whether or not to do the upgrade.

From a network management perspective, file extension and .INI management are even worse. Too many Windows applications assume you'll do an upgrade in place. They keep the same .INI name and don't bother to change the extensions even if the file formats have changed. It's hard, if not impossible, to build reasonable transition and support strategies with such applications.

I wish I could say that programs designed to run on networks had better installation programs, but they've just inherited the same problems of standalone PC programs. Next time I'll tell you why. □

I don't object to a vendor offering a default directory, but I want to put software where I want it.

Diane Danielle is an independent networking consultant in Berkeley, California. She can be reached on CompuServe at 70020,645 or MCI Mail at 383-1159.

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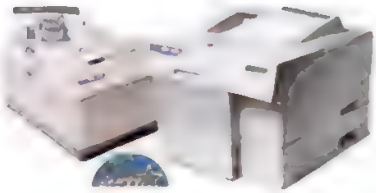

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CIRCLE 899 ON READER SERVICE CARD

Cooks and Broth: The Story of High-Speed Networking

Urrgh. Enough with tomorrow's networks. I'm tired of hearing about the next and greatest high-speed network. We've got too many to choose from already; any more will just make me want to throw out the cooks and the broth.

There's full-duplex Ethernet, right? Full-duplex Ethernet is supposed to give you a high-speed connection to your server by doubling Ethernet's speed. I think this one is going nowhere real fast.

Then there's Fast Ethernet or now IEEE 802.3u. We've talked a lot about Fast Ethernet. These are the guys—Grand Junction and 3Com to name two—who are speeding up Ethernet's signaling speed but basically keeping it's collision detection. I like 802.3u for now, particularly when combined with a switch to connect to a server, but over the long term I think there are better approaches.

The other fast Ethernet guys—100BaseVG—now fall into IEEE 802.12. Frank, I love the technology, but let me tell you that I just don't see HP and it's group using their marketing muscle to push the approach. I think we're looking at another Ethernet and Token-Ring battle. You can decide where 100-BaseVG falls in that war.

And don't forget trusty old FDDI. Sure FDDI is still expensive, but if you want to build a high-speed backbone it really is the best choice. And now that companies like Cabletron are knocking down their FDDI prices, building such a backbone is even more attractive.

David Greenfield: Keeping the specs straight is enough for anyone. You need fewer not more high-speed options.

Wait there's more. My favorite, Asynchronous Transfer Mode (ATM), is still here. It's got great long-term promise; expect to see ATM in the WANs and on the backbone shortly. But it's really best for places running real-time voice and video.

But some vendors think ATM is going to be too slow. Can you believe it? It's got 155 megabits of dedicated bandwidth, and they say it's too slow. Their point, or should I say an engineer at AT&T's point, was that with PCI running at 150 megabytes, tomorrow's networks will need at least a gigabit of bandwidth.

Keeping the specs and standards straight, Frank, is enough for anyone. Our readers need fewer not more high-speed options. The best the industry can do is coalesce around two solutions—one for the LAN and the other for the WAN—and forget the rest of these high-speed headaches.

Take two nodes and call me in the morning, David. Diversity is what makes a market. It also (if you hadn't noticed) keeps editors employed! Thinking that one networking or communications technology will dominate is the major act of self-delusion practiced by ATM advocates. My best advice for readers: Understand all the connectivity options, and use what makes sense when it makes sense.

There's power in diversity. It's a shame that you don't think much of full-duplex Ethernet, David. The blending of full-duplex and 100BaseT is a great combination. By itself, 100BaseT suffers from distance limitations, because the CSMA control technique requires that every node sense some part of the same packet at the same instant. So high speed and short packets drive down the allowable cable length. But if you roll full-duplex technology into 100BaseT, an action that's under way in the IEEE now, then you get 100-megabit connections for as far as you can push the signal across the cable without the need for retiming repeaters. Do that, and who needs to suffer the overhead of ATM in the campus backbone?

Frank Derfler: Understand all the connectivity options, and use what makes sense when it makes sense.

By the way, readers, the appeal of 100BaseT is another reason for our repeated advice to spend the few additional dollars for the 10/100 cards—particularly for your new PCI-bus computers. If you're buying any new Ethernet adapters, consider 10/100 boards.

When you select networking and communications technologies, look at the nature of the data going across the network. Estimating the volume of the data and the required response time only tells part of the story. Specifically, you have to consider whether the data is multipoint or point-to-point and whether it's bursty or streaming. Then add the dimension of distance (a major driver of cost), and you can make an informed decision.

For example, over long distances frame relay is perfect for bursty multipoint data while ATM is better for streaming multipoint. FDDI is great for streaming data going to multiple locations on a campus or urban area, but options such as full-duplex 100BaseT are more economical for point-to-point connections across similar distances.

Network planners face more variables and requirements than ever before, and they need a full suite of options to meet those requirements. □

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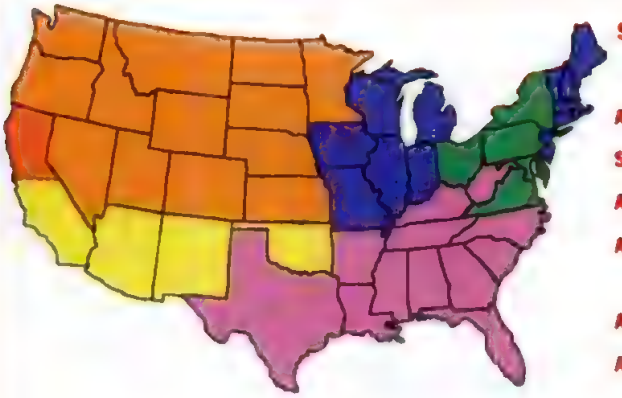

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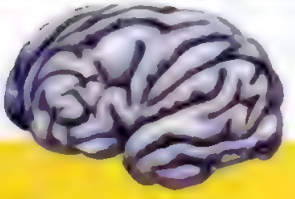

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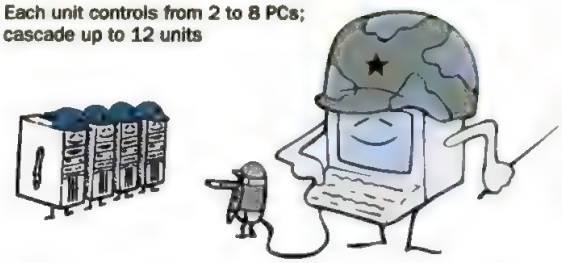

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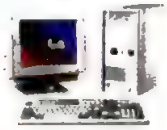

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PCTech

Win32 operating systems have greatly advanced the art of handling runtime errors and exceptions. This issue's Power Programming explains how you can take advantage of this in your applications.

User-to-User

BY NEIL J. RUBENKING

Adding Help to EDIT.COM

The June 14, 1994, User-to-User column gave instructions on making DOS command help more accessible from the DOS editor by swapping between the two using DOSSHELL. You can have simultaneous access to both, though, by replacing Edit's help with the command help for DOS. Here's how to do it:

- Rename the file EDIT.HLP to EDIT-HLP.OLD.
- Copy HELP.HLP to EDIT.HLP.
- Change the string "-9990" near the beginning of the new EDIT.HLP to "-9995".

Now, pressing F1 in Edit displays DOS command help. By resizing the windows you can edit a command while looking at help. Remember, this help is closed with Esc and not with Alt-F|X.

Svend Olaf Mikkelsen
Kobenhavn, Denmark

▶**PC MAGAZINE:** Once you install the DOS command help as described here, you won't have access to the Edit utility's own help system—not a huge drawback since Edit is extremely simple to use. With the DOS command help installed, you can even mark and copy lines from the help text directly into the file you're currently editing.

The one step that may give you a bit of trouble is finding the string "-9990" and replacing it with "-9995". Windows users can make the modification easily using Write. Load EDIT.HLP, choosing No Conversion when prompted. Search for "-9990", change the 0 to a 5, and save the file. That's it!

To make the patch under DOS, you'll need to use DEBUG. Start with the command `DEBUG EDIT.HLP`. Now at DEBUG's dash prompt, enter

```
s cs:100 l 0 '-9990'
```

DEBUG will respond with a nine-character address of the form 0B9F:08C5. Now enter the command

```
e xxxx:xxxx '-9995'
```

substituting the address returned by DEBUG for xxxx:xxxx. Enter W for Write and Q for Quit and you're done!

Why the particular strings "-9990" and "-9995"? I have no idea, but I'm grateful to this reader for discovering them!

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The CHOICE Command

The CHOICE command in DOS 6.*x* lets you put a timed pause into a batch file—a significant improvement over the PAUSE command, which only resumes execution if the user presses a key.

When my computer boots, it displays a message that disappears either when you press a key or—if you don't—after 30 seconds. I use the line

```
CHOICE /C:zxcvbnm /T:b,30>NUL
```

in my AUTOEXEC.BAT, following the message that I want displayed. Execution drops through to the next command if any alphabet key on the bottom row of the keyboard (z, x, c, v, b, n, or m) is pressed, or if no key is pressed after 30 seconds. I used all the alphabet keys on the bottom row to give a wide area to aim at, but any number of characters can follow the /C: switch. The character after the /T:, however (which CHOICE uses as the default if no key is selected), must be one of the keys designated in the /C: switch. The time delay can range from zero to 99 seconds.

W. T. Marchant
Halifax, Nova Scotia, Canada

▶**PC MAGAZINE:** CHOICE waits until the user presses one of the keys in its list and then sets the DOS ERRORLEVEL to that key's position in the list. For example, if the user presses c in response to the command `CHOICE /C:abc`, CHOICE sets the ERRORLEVEL to 3, since c is the third character in the list.

Sometimes, though, you want a delay the user can't interrupt so easily—to display a 30-second copyright notice, for example. In this case, you can use CHOICE strictly for its time delay (without worrying about which key will be pressed) by using a single difficult-to-enter character for the command's character list. You

could use a line like the following, for example

```
CHOICE /C:_/T:_,30>NUL
```

where the underscore represents ASCII character 255. (In most text editors, you enter an ASCII 255 by holding down the Alt key, tapping 2 5 5 on the numeric keypad, and then releasing the Alt key.) Since ASCII 255 looks just like a space, the user won't learn much, even by peeking inside your batch file.

You can create even longer delays by using the FOR command to repeat the CHOICE-based delay, as in the following line:

```
FOR %%v IN (x x x x x x x x x x)
 DO CHOICE /C:_/T:_,60>NUL
```

CHOICE will wait 60 seconds for each of the ten x's in the FOR command's list. Thus, this line will cause a batch file to delay ten minutes and then continue execution.

Restricting Windows Usage

I currently use only one Windows application: Microsoft Word for Windows. Since I still do most of my work in DOS, I want a way to exit both Word and Windows in one step rather than having to close Word and then also quit Windows. Your WINCMD utility (for more information, see the Utilities column in your issue of April 27, 1993) provides the way.

Figure 1 shows the WINCMD file I use with Microsoft Word. It allows me to run Word and then exit without having to wait and exit Windows too. Also, if I try to switch programs, WINCMD exits Windows. Figure 2 shows how you can run several Windows applications this way. You can switch back and forth between the applications, but as soon as you close them all or activate another, Windows terminates.

```
C:\WINWORD\WINWORD
while ( GetAppExe(GetAppActive() ) = C:\WINWORD\WINWORD.EXE )
  Do
  End
AppActivate("Program Manager")
SendKeys("%{F4}{enter}")
```

Figure 1: **This WINCMD script terminates Windows when WinWord is no longer the active application—handy if you only want to run WinWord.**

```
C:\WINWORD\WINWORD
C:\WINDOWS\WINMINE
AppOk = True
while AppOk = True
 Do
  AppOk = False
  if (GetAppExe(GetAppActive()) = C:\WINWORD\WINWORD.EXE)
    then AppOk = True
  if (GetAppExe(GetAppActive()) = C:\WINDOWS\WINMINE.EXE)
    then AppOk = True
 End
AppActivate("Program Manager")
SendKeys("%{F4}{enter}")
```

Figure 2: **This variation on the previous WINCMD script exits Windows when both WinWord and MineSweeper terminate or any other program becomes active.**

```
LaunchSpecial LC_WAIT C:\WINWORD\WINWORD
AppActivate("Program Manager")
SendKeys("%{F4}{enter}")
```

Figure 3: **The latest version of WINCMD makes it possible to write a script that will terminate Windows when a specified program is closed.**

George Sansing, Jr.
Jackson, Mississippi

►PC MAGAZINE: This tip comes in handy if you use Windows in order to run one or two particular applications only.

You can get WINCMD from PC MagNet's Utilities/Tips Forum, Library 2. Download WINCMD.EXE (for the program itself), plus the two WINCMD function libraries WCLIB.WCL and WCL2-.WCL. Use File Manager to create an association between files with the extension .WCM and WINCMD, and then simply put an icon for WORD.WCM (or the variant of your choice) in your Startup group. (Note that if you've maximized one program group, the Program Manager's window title will be, for example, Program Manager - [Main]. Since the script is looking for just "Program Manager" by itself, it will fail.)

WINCMD 1.4 (the current version) includes a new command, LaunchSpecial, which will be useful here. Mr. Sansing's script shuts down Windows if, for example, you switch from WinWord to the Program Manager. If you want to close your Windows session only when the selected application terminates, not just when it ceases to be the active app, use the code in Figure 3. The LaunchSpecial command with the LC_WAIT parameter launches the specified program and then waits until that program terminates before executing the remaining lines of the .WCM file.

Another WINCMD function called IsRunning lets you create a .WCM file that will terminate Windows only when all of a selected set of applications are closed. Figure 4 shows how. WINCMD starts the desired applications (here WinWord and MineSweeper) and then enters a loop that continues as long as either application remains running.

```
C:\WINWORD\WINWORD
C:\WINDOWS\WINMINE
while IsRunning(C:\WINWORD\WINWORD.EXE) OR IsRunning(C:\WINDOWS\WINMINE.EXE)
  Do
  End
AppActivate("Program Manager")
SendKeys("%{F4}{enter}")
```

Figure 4: **Using another feature of the current WINCMD, this script launches two programs and terminates Windows when both programs are closed.**

One caution: If you put a file like WORD.WCM into your Startup group, you'll have to resort to trickery to get it out, since any attempt to switch out of Word and into the Program Manager will cause WINCMD to close Windows. Simply rename the trouble-making .WCM file in DOS, and then start Windows. WINCMD will generate an Application Execution Error dialog when it attempts to access the command file. Click the OK button and you'll be free to make the necessary changes. □

Invasion of the 64-bit Graphics

- Fast 64-bit Acceleration
- Affordably Priced from $179**
- Instant Windows Mode Switching

The squadron of 64-bit graphics accelerators from ATI – the GRAPHICS PRO TURBO, WINTURBO and GRAPHICS XPRESSION – has landed. Affordably priced from only $179, they're attacking computers with rocket-like performance, laser sharp graphics and galactic true colors.

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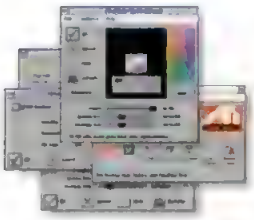
Resistance is futile. High resolutions of up to 1280x1024 and 16.7 million true colors will overwhelm you. These advanced accelerators propel applications faster in true color than other cards using just 256 colors. And the superior performance, up to 42 million Winmarks*, will conquer even the most complex applications. Plus, the flicker-free display – at up to 100Hz – reduces eye-strain over prolonged periods of attack.



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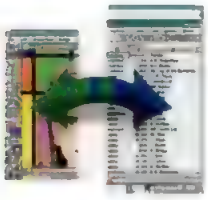
Propelling Windows

Armed with an arsenal of utilities to enhance Windows, the *mach64* graphics accelerators breeze through Windows applications quickly and effortlessly. The unique WinSwitch feature allows color and resolution to be changed - *without restarting Windows.* A stellar range of software drivers enable popular operating systems to be explored – OS/2, UNIX, Windows NT, CAD, DOS and others.



WinSwitch
Change resolution and color without exiting Windows

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* WinBench 4.0 and PC Bench 8.0 performance tests done on a Pentium 90MHz, 16MB RAM, 256K cache, 420 MB HD, using 2MB and 4MB PCI graphics cards. WinBench 4.0 at 1024x768/256 colors (large fonts) and 800x600 in 16.7M colors (small fonts) at 70Hz refresh rate.
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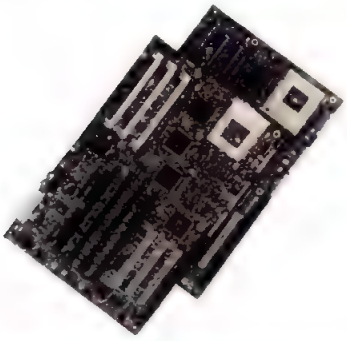

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Tutor

BY JEFF PROSISE

Print DOS Screens From Windows

One pesky little problem that bothers new and veteran Windows users alike is the inability to print the screens of DOS programs running under Windows. When you press the PrtSc key in a DOS application running under plain DOS, a routine inside your PC's ROM BIOS outputs the screen to the printer. (If the DOS app is running in graphics mode, you must have DOS's GRAPHICS utility installed. In this case, it's the memory-resident code of GRAPHICS, not that in the BIOS, that performs the screen dump.) But press PrtSc when the same app is running in a DOS session under Windows, and nothing happens.

Actually, something does happen. Depending on whether the DOS app is running full screen or in a window, Windows steps in when PrtSc is pressed and either copies the text of the screen to the Clipboard (if the app is running full-screen) or copies the entire graphics-mode Windows screen to the Clipboard (if the app is running in a window). Either way, the DOS screen no longer goes directly to the printer. And either way, the only way to get a hard copy is to paste graphical Clipboard data into an image-editing program or text Clipboard data into a text editor and then print the results. That's a lot of work just to get a text-mode screen dump, and it's quite a bit slower because of the extra steps involved. Nothing could be simpler than pressing PrtSc and having hard copy automatically appear on the printer.

So what's the solution? Does running Windows mean you can no longer get those quick-and-dirty screen dumps you used to get in DOS? Fortunately, you can—if you run Windows in 386 Enhanced Mode (as the vast majority of Windows users now do) and use the techniques described here. We'll explore two methods for restoring the PrtSc key to DOS-style operation while a DOS session is active in enhanced-mode Windows—one method involves a simple change to a PIF, and another utilizes a custom virtual device driver, or VxD.

THE PIF SOLUTION The PIF solution is ideal when you wish to restore the PrtSc key to DOS-style operation for some DOS apps but not for others. In 386 Enhanced Mode, Windows gives you the option of defining run-time settings for DOS apps through Program Information Files, commonly referred to simply as PIFs. PIFs are created and edited with the PIF Editor, which can be found in Windows' Main program group.

If you start the PIF Editor, you'll see a button labeled "Advanced" near the bottom of the PIF Editor window. Clicking the button reveals the Advanced Options dialog box pictured in Figure 1. In the Other Options section, the check boxes for the Reserve Shortcut Keys enable you to specify certain keys that have special meaning to a DOS application and that Windows should therefore ignore. By default, the PrtSc box is unchecked. When this box is unchecked, Windows handles presses of the PrtSc key itself, preventing the virtual machine (VM) in which the DOS app is running (and in which the print screen code in the BIOS is loaded) from realizing that PrtSc was pressed. Checking this box tells Windows to treat PrtSc with a hands-off policy, allowing presses of this key to flow unimpeded to the DOS VM.

To reenable the PrtSc key for a given DOS application, open the PIF associated with that application, click the Advanced button, check PrtSc (as shown in Figure 1), click OK, and save the modified PIF settings before leaving the PIF Editor. Now when that DOS app is launched, the PrtSc key should function just as it would outside of Windows, producing a text dump to the printer attached to LPT1.

The advantage to this method—or disadvantage, depending on how you look at it—is that other DOS apps are unaffected by the change to the PIF. By selectively editing your PIFs, you can have some DOS apps respond to print screen requests with hard copy and let others function as they normally do under Windows. The important thing to realize is that only DOS apps whose PIFs reserve the PrtSc key will benefit from this technique. If you want to enable PrtSc for all your DOS apps that don't have their own PIFs, you'll have to check the PrtSc box in _DEFAULT.PIF, whose settings Windows uses when you start a DOS program that doesn't have its own PIF.

THE VPRTSCD SOLUTION If your desire is to reenable the PrtSc key globally for DOS apps under Windows, there is a better way to go about it than editing all your PIFs.

That better way is a VxD. VxDs are 32-bit protected-mode programs that attach themselves to Windows' Virtual Machine Manager (VMM) and run in ring 0, the most privileged access mode of

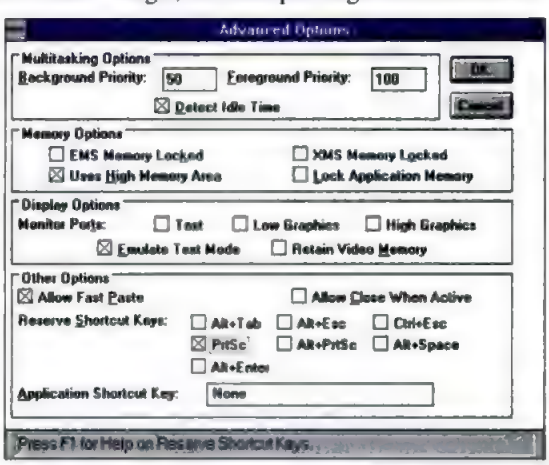

Figure 1: **This dialog box of Windows' PIF Editor lets you restore the operation of the PrtSc key for a single program.**

a 386, 486, or Pentium CPU. In the VMM, VxDs enjoy access to the innermost reaches of Windows. VxDs are intended primarily for virtualizing access to hardware devices such as timers, interrupt controllers, and video adapters. They are also useful for modifying the behavior of Windows — especially when it comes to making DOS apps do things that would otherwise be impossible in Windows' highly structured protected-mode environment. For a more in-depth background on VxDs, see the Tutor column in our issue of May 31, 1994 ("Adventures in Flatland with VxDs").

A prime example of the far-reaching powers that VxDs enjoy—and of the magic that they can perform—is VPRTSCD.386, a VxD that I wrote to reprogram the PrtSc key so that it acts in a very special way. With VPRTSCD, the PrtSc key operates as it normally does under Windows. However, if you press PrtSc with either of the Shift keys pressed while a DOS VM is active, the keystroke is transmitted to the VM regardless of whether PrtSc is checked in the app's PIF. In other words, you can press Shift-PrtSc to send a screen from a DOS VM to the printer. And it works all the time, every time. Of course, if the DOS app whose screen you're shooting is running in graphics mode, you'll still need to have GRAPHICS loaded. (Be sure to load GRAPHICS before Windows starts: Loading GRAPHICS from the command line inside a DOS VM may cause unpredictable behavior.) And if you want to copy the screen to the Clipboard, you may still do so by pressing PrtSc without the Shift key.

HOW VPRTSCD WORKS VPRTSCD.386 uses the VKD (Virtual Keyboard Device) VxD's VKD_Define_Hot_Key service, which is documented in the Windows DDK (Device Driver Kit), to set up a callback procedure that is called whenever Shift-PrtSc is pressed. A *callback procedure* is a routine that Windows calls in response to certain program events, such as keystrokes or changes in the state of the system. When its callback procedure is activated, VPRTSCD uses the VMM's Get_Cur_VM_Handle and Test_Sys_ VM_Handle services to determine whether the active VM is a DOS VM or the system VM (in which all Windows applications run).

If a DOS VM is active, VPRTSCD uses the VMM's Exec_Int service to simulate an interrupt 05h in the VM; this is the same interrupt generated when PrtSc is pressed in DOS. This interrupt, in turn, activates the BIOS interrupt handler that outputs a text-mode screen to the printer. (If GRAPHICS is installed and the DOS VM is currently running a graphics-mode app, GRAPHICS intercepts the interrupt and performs the screen dump.) If, on the other hand, the system VM is active, then VPRTSCD calls on VKD's VKD_Reflect_Hot_Key service to pass (or *reflect*) the keystroke into the system VM. The PrtSc key is thus unaffected when the system VM is the active VM.

USING VPRTSCD To install VPRTSCD, simply add a `DEVICE=VPRTSCD.386` statement to the [386Enh] section of Windows' SYSTEM.INI file, which should be located in the Windows directory. To ensure that Windows can find the VxD, specify the path to VPRTSCD.386 as well. If VPRTSCD.386 is stored in C:\DRIVERS, use the statement

```
DEVICE=C:\DRIVERS\VPRTSCD.386
```

Then restart Windows so the modification can take effect, and you should be able to print DOS screens by pressing Shift-PrtSc with any DOS session that's active.

How do you get a copy of VPRTSCD.386? The easiest way is to log on to PC MagNet and download it from the Tutor section of the Utilities/Tips Forum. If you're modemless, type in the DEBUG script shown in Figure 2. Store the script in a file named VPRTSCD.SCR, and afterwards type

```
DEBUG <VPRTSCD.SCR
```

to create VPRTSCD.ZIP, which you must then unzip with PKZIP 2.0 or later (or an equivalent) to get VPRTSCD.386. The unzipped file is more than 4K in length, far too long to print as a DEBUG script. That's why the DEBUG script creates a compressed version of the file.

THE WINDOWS WAR Windows isn't perfect, and as with any operating environment, overcoming its imperfections is an ongoing war. The key to winning a war, of course, is winning the battles. The tools and techniques presented here should be sufficient to turn the tide of the PrtSc battle. If there are other features of Windows that you'd like to see explored in this column, drop me a line in the Tutor section of PC MagNet's Utilities/Tips Forum. □

```
N VPRTSCD.ZIP
E 0100 50 4B 03 04 14 00 00 00
E 0108 08 00 FB 71 1E 1D 2C EF
E 0110 C8 4C A6 01 00 00 4F 12
E 0118 00 00 0B 00 00 00 56 50
E 0120 52 54 53 43 44 2E 33 38
E 0128 36 ED 98 41 6B 13 51 10
E 0130 C7 FF CF 24 6E BB 66 D3
E 0138 92 D2 5B 31 53 A8 97 22
E 0140 C5 92 43 21 BD 94 76 73
E 0148 4B 8D 98 12 41 C4 12 6D
E 0150 D4 40 B2 5B 36 C9 AD 87
E 0158 C0 96 5E CA F6 94 0F D1
E 0160 43 0B 39 04 85 20 6C AE
E 0168 7B F1 5B 08 1E 45 7A 50
E 0170 E2 BC EC 6E 0B 45 54 C4
E 0178 E3 FB C1 EC CC 9B 37 6F
E 0180 DE CC B2 97 D9 DD E7 65
E 0188 E8 00 92 2C 93 09 30 44
E 0190 C8 16 FE 4C 8F 25 93 7B
E 0198 9F C1 60 36 58 1E 8A 52
E 01A0 B0 BC F7 AE D1 A6 43 C7
E 01A8 7E EB D4 5A F4 BA 66 59
E 01B0 76 87 5E D5 C9 E9 5A D4
E 01B8 B0 C8 2C 57 A8 65 1F D4
E 01C0 D7 0C 7D 25 CE 51 2A 86
E 01C8 FA CE B4 02 80 7A D2 FE
E 01D0 05 F3 C0 2A 42 91 3C 8E
E 01D8 F4 18 61 FC D7 5B E1 DF
E 01E0 59 34 71 B3 CE B2 7D 9F
E 01E8 A5 10 F9 36 E3 3D 3E 2C
E 01F0 CD D5 2C F0 00 FF 82 9E
E 01F8 38 8F AC 22 85 B9 E2 D4
E 0200 0F A3 BA 17 29 AC F1 A6
E 0208 1C 31 BD 58 AB 3E 79 BA
E 0210 57 D9 31 A5 23 21 90 78
E 0218 71 BD 9F 61 59 92 1D A0
E 0220 23 63 67 70 57 26 D0 90
E 0228 86 48 B3 CA 41 F4 F1 7F
E 0230 70 AF 44 37 F5 F9 DB 1C
E 0238 70 E5 9F FA 01 09 BE 2F
E 0240 A0 24 3F BB 5A 40 29 18
E 0248 F0 DD 2F CD 67 DE D1 4A
E 0250 32 20 8F DD FB 01 B9 AC
E 0258 06 29 3E 1C D0 F1 34 FC
E 0260 84 9F 55 AF 23 43 CE D8
E 0268 7C E9 8E 9B FE F5 DB 09
E 0270 BB 8D 5A A5 E8 B3 F9 2D
E 0278 45 C7 B1 9D 02 C5 47 DE
E 0280 D4 1A CD FA 81 A1 FF 6D
E 0288 4B 0A 85 42 A1 50 28 14
E 0290 0A 85 42 A1 50 28 6E 71
E 0298 B1 31 98 7C 10 F0 7E 5C
E 02A0 8A 51 9A D7 F9 4F F9 89
E 02A8 FC 0B 60 A0 6D E4 3F 8E
E 02B0 FA D3 29 7F C4 23 BC BF
E 02B8 10 CF E3 D5 BA D3 6E D8
E 02C0 16 AD AF 3D 02 EE 45 DE
E 02C8 7D D3 DC E6 39 FF 27 50
E 02D0 4B 01 02 14 00 14 00 00
E 02D8 00 08 00 FB 71 1E 1D 2C
E 02E0 EF C8 4C A6 01 00 00 4F
E 02E8 12 00 00 0B 00 00 00 00
E 02F0 00 00 00 00 00 20 00 00
E 02F8 00 00 00 00 00 56 50 52
E 0300 54 53 43 44 2E 33 38 36
E 0308 50 4B 05 06 00 00 00 00
E 0310 01 00 01 00 39 00 00 00
E 0318 CF 01 00 00 00 00
RCX
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Figure 2: **This DEBUG script creates VPRTSCD.ZIP, which produces VPRTSCD.386 when decompressed with PKZIP 2.0 or higher.**

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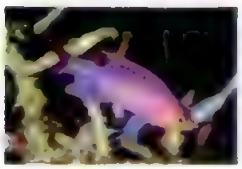

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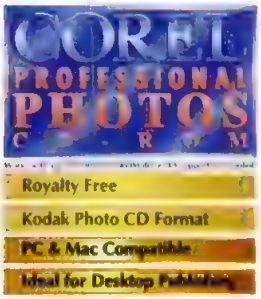

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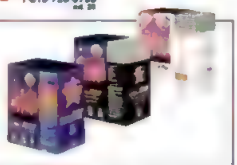

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CIRCLE 211 ON READER SERVICE CARD

Extending Your Apps

BY NEIL J. RUBENKING

The Structure of a Help System

It's time to update the old saying "The job isn't over till the paperwork is done." When it comes to writing Windows applications, the job isn't truly over till the help system is done. A printed manual is no longer sufficient or even necessary, but on-line help is a must—and context-sensitive help is even better. Fortunately, modern tools make help-system creation simple, so there's just no excuse for skipping this step.

Even the best tools won't do the work for you, though. To build a decent help system, you need to write clear and simple text that explains how your program works. You also need to program the connections between the topics of your help system. Most of all, though, you need to understand all the elements of a good help system. You can be the world's best programmer and still produce an inadequate help system if you aren't familiar with all the features WINHELP.EXE (the built-in Windows help engine) offers. This article will explain the elements of a help system, both simple and advanced. It won't discuss the nitty-gritty details of help-system construction, since those will vary depending on the design tool that you use.

Figure 1 is a screenshot of a sample help system you can refer to as you read this article. The sample help system was designed strictly to show as many help features as possible—it's not meant as an example of good layout and design!

WRITING HELP TOPICS Just as a book is divided into pages, a help system is divided into topics. A topic should cover a single concept, and most topics should contain no more than one screenful of text. Every topic has a title and a context string. From the user's point of view, the title is the name of the topic. For example, when WinHelp's Search dialog displays a list of topics, what it shows is the titles of the topics. Each topic's unique context string identifies the topic to WinHelp internally. Common practice is to make the context string the same as the title, replacing any spaces with underscores—many help-creation tools do this automatically. You can optionally assign a unique context number to each topic. Context numbers are useful when working with programming environments like Microsoft Visual Basic, in which menu choices and on-screen controls can be linked directly to help-context numbers.

Frequently one topic will refer to information that's covered in more detail in another topic. A printed manual would use a reference like "(see page 27)"; a help system can incorporate a jump directly to the other topic. A word or phrase is designated as the hot spot for the jump—the help system underlines the hot-spot text and, by default, displays it in green. Jumps are sometimes called links or hypertext links. When the user clicks on a jump hot spot, the help system switches to the specified target page. To return from one or several jumps, the user simply clicks WinHelp's Back button.

A printed manual might insert the definition of an unfamiliar word or phrase as a footnote. Help systems use a pop-up topic instead. The word or phrase designated as the pop-up hot spot is displayed in green by default, with a dotted underline. Clicking on the pop-up hot spot doesn't switch to a new topic. Rather, it causes the text of the pop-up topic to appear in a window that seems to float above the main WinHelp window. Another mouse click disposes of the pop-up window. As discussed below, bitmap images in the help system can also be hot spots for jumps or pop-ups.

Note that although the text of jump and pop-up hot spots is green by default, the user can choose different colors. Adding a JumpColor key to the [Windows Help] section of WIN.INI changes the color of both jumps and pop-ups; adding a PopupColor key sets the color of pop-ups alone. The value for each of these keys consists of three numbers from 0 to 255 indicating the amount of red, green, and blue in the color. For example:

```
JumpColor=192 0 0
PopupColor=0 0 192
```

would cause WinHelp to display jump hot spots in a medium red and pop-ups in a medium blue.

NAVIGATING THE HELP SYSTEM Every help system must have a Contents topic; it's a kind of "home base" for the help system, and its title is usually just "Contents" or "<program name> Help Contents." This is the topic that WinHelp displays when no specific topic is requested, and WinHelp's Contents button jumps straight to this topic. Usually the Contents topic contains almost nothing but jumps

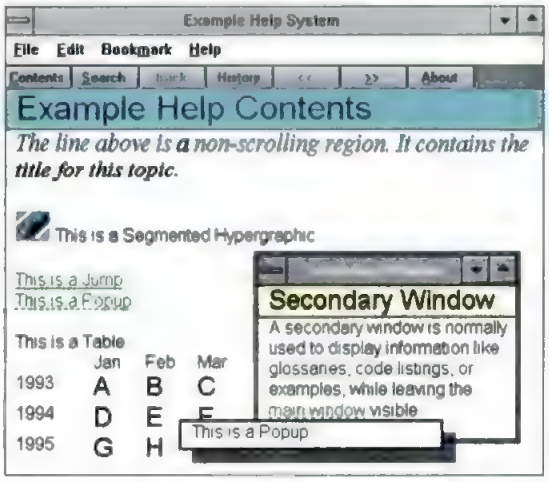


Figure 1: **Most of the elements of this sample help system explain themselves. The About button and the browse buttons were added using help macros.**

Snapping Your Screens

You don't need a fancy screen-capture utility to take a snapshot of your program's main window. Run your program and press Alt-PrtSc to copy the active window to the clipboard. Launch Paintbrush and maximize it, then paste in the contents of the clipboard. (If the image is too big, try removing the check marks next to Tools and Linesize and Palette under the View menu and paste again.) Now select Cursor Position from the View menu, and place the mouse cursor precisely at the bottom right corner of the image. Note the *x,y* coordinates in the cursor-position window.

From the Options menu, select Image Attributes. In the resulting dialog box, click on the "pels" radio button (*pels* means pixels), and fill in the Width and Height boxes with the noted coordinates of the image's bottom right corner. Click OK, answer Yes to the warning that the current image will be lost, and answer No to the query about saving current changes. Now paste the clipboard into Paintbrush again. If you've done everything right, the image will precisely fit the working area of Paintbrush. Select Save As from the File menu, and set the file type to "16 color bitmap." Choose a name and save the file. You've snapped the screen!

to other high-level topics. You may want to think of the Contents topic as being equivalent to the table of contents in a book, and the jumps the Contents topic contains as equivalent to the beginnings of chapters. A simple Contents topic might contain jumps to topics explaining each of the program's windows and each of the top-level menu items. The user will see the Contents topic a lot, so it should be orderly and attractive. Every single additional topic should be accessible, via one route or another, from the Contents topic.

The jumps in a well-written help system form a complicated web of connections. One topic may include jumps to a dozen others, or a dozen topics may all have jumps to one topic. A series of jumps may form a loop, bringing you back to the starting topic. For example, in WinHelp's own help system the "Searching for a Help Topic" and "Moving Around in Help" topics both include jumps to each other. This free-association network is convenient for the user who's pursuing a particular train of thought, but it's not much use when you want to "skim" the help system. A good help system will also include one or more browse sequences (see Figure 2). A *browse sequence* is a linear series of related help topics intended to be read in order. Each topic can belong to one and only one browse sequence. When the current topic belongs to a browse sequence, WinHelp's browse buttons (marked with << and >>) are enabled. Pressing a browse button flips to the previous or next topic in the current browse sequence.

How do you decide which topics to link in a browse sequence? It's up to you, of course, but here are some guidelines. In a very small help system, you'll create a single browse sequence that includes every topic. Start with the Contents topic and add the remaining topics in any order that makes sense to you. In a larger help system, start a browse sequence with each of the "chapter heading" topics reached by a single jump from the Contents topic. Again, arrange the topics in an order that makes sense to you, and make sure that every topic is included in one browse sequence.

Keywords are words and phrases that serve as the help system's index. Each topic can have any number of associated keywords, though more than three or four is unusual. WinHelp's Search dialog initially displays a list of all keywords in the help file in its upper list box. When you select one, the lower list box fills with a list of all topics associated with that keyword (see Figure 3). Keywords give the user a quick way to dive into a particular topic. Note that a keyword need not appear literally in the topic's text.

Assigning keywords to topics can be a tedious task, but it's extremely important. Pick descriptive words and phrases for keywords, and assign at least one keyword to every topic. If nothing else, use the topic's title as a keyword. It's very important to be consistent in your keywords. Don't use "open files" for one topic and "open file" for another, for example. Some help-design tools make it easy to reuse existing keywords. If yours doesn't, it's a good idea to keep a list of the keywords you've already added to the system, and reuse them when possible.

WORKING WITH GRAPHICS Windows is a graphical user interface, and Windows help systems are definitely improved by the judicious use of bitmapped graphics. Graphics may be purely decorative, like a company logo on the Contents topic, or they may be an active part of the help system with embedded hot spots. The technical term for bitmaps that include hot spots is *segmented hypergraphics*, and Microsoft's freely available SHED editor can turn an ordinary bitmap into a segmented hypergraphic (.SHG) file. A graphical hot spot is linked to its topic via the topic's context string. Modern help systems often incorporate a bitmap of the program's main screen, in which a graphic hot spot for each on-screen element of the main window jumps to a help topic explaining that element.

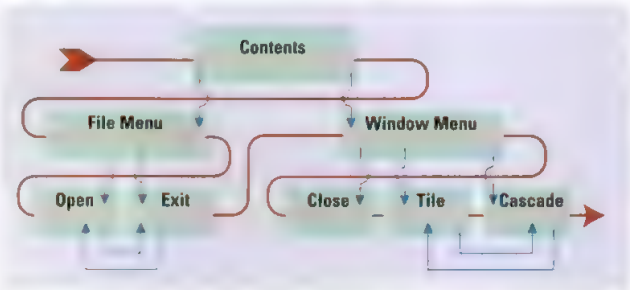
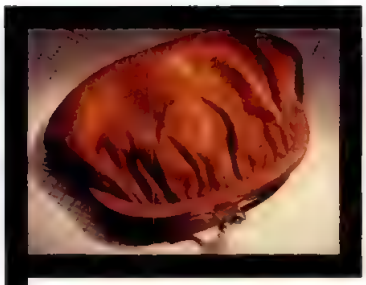


Figure 2: **In this simple help system, jumps (blue arrows) make a web of connections between the topics. The browse sequence (red arrow) is a linear path through the help system that visits every topic exactly once.**

First *we* meet *your* specs.

Then *we* make *your* accountant giddy.



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Choosing Your Tools

It's possible to build a help system using just three tools: a Windows word processor that can generate .RTF (Rich Text Format) files, the Windows Help Compiler, and the SHED graphics editor. You can download the latter two from CompuServe's WINSDK forum, Library 16, as HCP.ZIP and SHED.ZIP. But writing a help system this way is as tedious and counterproductive as assembling the bytes of your Windows application using DEBUG. Modern tools such as RoboHelp, from Blue Sky Software Corp. (reviewed in "Word Processing Utilities: RoboHelp Uses Word to Build Windows Help Files," *PC Magazine*, August 1994), and Doc-to-Help, from WexTech Systems ("Word Processor Add-Ins," February 9, 1993), work with your word processor to generate the necessary RTF file. Other tools such as The Windows Help Magician, from Software Interphase ("Create Help Files Quickly With The Help Magician," July 1993), and ForeHelp, from ForeFront ("ForeHelp: Help-File Heaven," October 25, 1994), provide their own WYSIWYG help editors. This is not an exhaustive list; there are help-design tools to suit every need and budget.

In many cases, the tools Windows itself provides are sufficient to let you create a bitmap of your program's main window, as the sidebar "Snapping Your Screens" explains. Regardless of whether or not you intend to create graphical hot spots in the bitmap, you should load it into the SHED editor and save it as an .SHG file. Why? Because the .SHG file format uses compression, and the .BMP format does not. An .SHG file can be substantially smaller than a corresponding .BMP file. To create a graphical hot spot in the SHED editor, you use the mouse to drag a rectangle that defines the hot spot area, and you associate the hot spot area with the context string of the corresponding help-system topic as shown in Figure 4.

Bitmaps make your help file bigger, even when stored as compressed .SHG files. Don't overuse them! For a simple program, one picture of the main window may be enough. And remember that although help text in topics wraps when the help window is resized, bitmaps can't. Always use the smallest bitmap that will do.

USING HELP MACROS A basic help system consists of help topics linked by jumps and browse sequences, with a set of keywords to serve as an index. It may include bitmapped graphics as well. However, to go beyond the basics you'll need to learn about help macros. The jump and pop-up hot spots that you embed in help topics are effectively commands to WinHelp, telling it to jump to a particular topic or display a pop-up window. Help macros are another kind of command for WinHelp. There are over 50 macros that can be programmed to activate when the help system loads, when a particular topic is activated, or when the user clicks on a hot spot. This article won't attempt an exhaustive discussion of each help macro; what's important is that you understand the kinds of commands that are available.

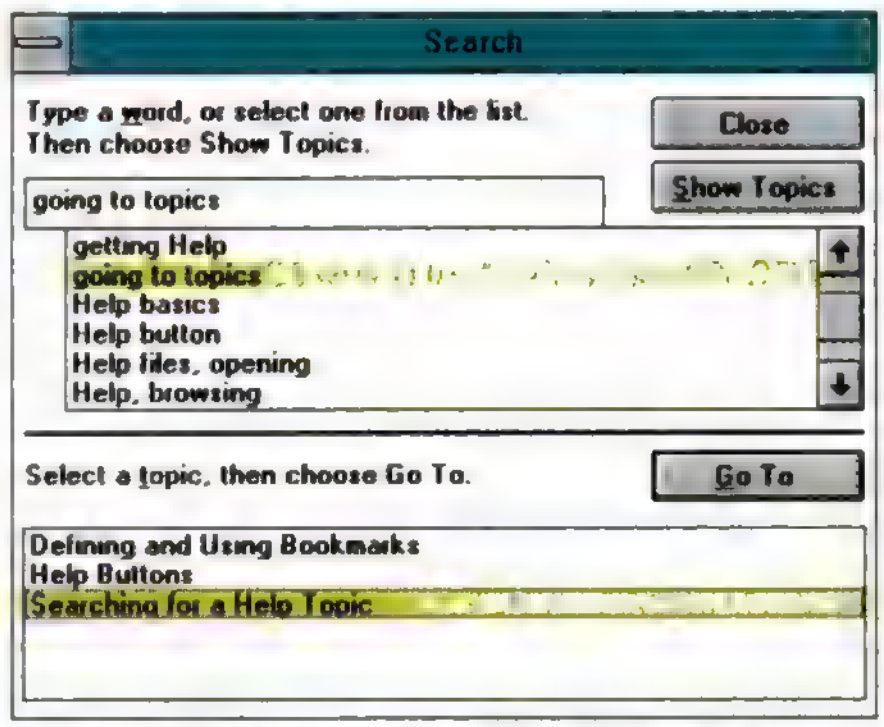

Figure 3: **The top list box of WinHelp's Search dialog lists all keywords in the help system; the bottom list box shows all topics related to the selected keyword.**

A dozen or so of the macro commands let you create, delete, enable, disable, and change the effect of a WinHelp menu item or button. The result (called the binding) of activating a menu item or button is always a macro. Another 20-odd macro commands duplicate the effect of WinHelp's built-in menu and button commands. For example, the Next macro switches to the next topic in the current browse sequence, and the About macro displays WinHelp's About box. In the sample help system shown in Figure 1, this macro creates the About button and binds it to the About macro:

```
CreateButton ('About', '&About',
 'About()')
```

Yet another group of macros gives complete control over jumps and pop-ups within this file or into any other help file.

Possibly the most common macro command is BrowseButtons, which adds the standard browse buttons to WinHelp's button bar and is usually activated at the time the help system loads. Your help system should include browse sequences, so you'll definitely need to use BrowseButtons. Some help-design tools automatically include the BrowseButtons macro when any browse sequences are present.

Certainly the flashiest WinHelp macro commands are ExecProgram and RegisterRoutine. ExecProgram launches the Windows application of your choice. You might, for example, create a button that activates a computer-based training program using ExecProgram. RegisterRoutine gives your help system access to any Windows API function or any function defined in a DLL (Dynamic Link Library). Once a function is registered, you call it just as if it were another macro. RegisterRoutine is often used to add multimedia support to help files: for example, to play a .WAV file for pronunciation when the user clicks on an unusual word.

DETAILING THE HELP SYSTEM Expert help-system designers can add a number of refinements. Give a finishing touch to the text in your help topics by using multiple fonts and font effects such as bold, italic, and underline. Since you don't know what fonts your users will have installed,

VB Power

ISBN: 1-56276-073-4
Price: $34.95

This innovative guide by Dan Appleman turns Visual Basic programmers into power users by illuminating the tools of the Windows Application Program Interface (API). Includes a time-saving disk that contains source code from the examples in the text, plus a specially designed dynamic link library (DLL).

Available at fine bookstores, or call 1-800-688-0448 ext. 8448

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Figure 4: **In this sample bitmap of a program's main window, each menu item and icon is designated as a graphical hot spot. The Attributes dialog box is displaying details about the window-menu hot spot.**

you should only use the fonts Microsoft Windows 3.1 loads by default: Arial, Courier New, MS Serif, MS Sans Serif, Symbol, Times New Roman, and Wingdings.

Topic text wraps to fit the width of the WinHelp window. If it won't all fit, a vertical scroll bar appears. Once the user scrolls into the topic, the topic heading isn't visible! If you put the topic heading in a non-scrolling region, it won't disappear when the text scrolls. You can give the non-scrolling region its own background color too, as Figure 1 shows.

If your help system needs to present tabular data, don't torture yourself trying to line up items using Tab characters. WinHelp includes direct support for tables. But creating a table "by hand" using WinHelp codes is incredibly tedious and difficult. This is one case where a good design tool is absolutely essential.

In some instances it makes sense to enhance your help system with one or more secondary windows. For example, the help system in Microsoft Word for Windows, Version 6.0 uses a secondary window for "How To" topics, and the help system for many programming environments uses a secondary window to show examples of the use of various program elements. Figure 1 includes a secondary window; note that the secondary window has no menu or button bar.

HOW SENSITIVE SHOULD YOU BE? Your program's help system need not be context-sensitive. As long as it includes the standard help-menu items, the user can instantly view the Contents topic or search for help on a given keyword. If the help system is well organized, context-sensitive help may not be necessary. On the other hand, if the development environment you're using has support for context-sensitive help built in, you can give every window, every menu item, and every on-screen control its own personal help topic.

Precisely how context-sensitive you make your help system is a case-by-case matter and can't be defined by rules. My own suggestion, however, is a compromise between no context-sensitive help and a topic for every push button. If your program has multiple windows and dialog boxes, devote a help topic to each of these, and write your code so that pressing F1 (the standard help key) brings up the help topic for the current window. For menu items and controls, display a single-line "hint" on the program's status bar for the menu item or control that currently has the focus. If your development environment supports it, create "flyover help" or "tooltips" for toolbar items. *Flyover help,* as shown in Figure 5, is a tiny box

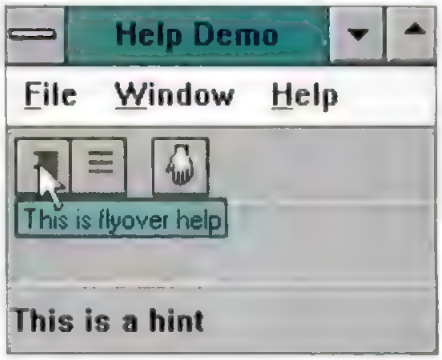

Figure 5: **This demo application shows a flyover help box for one of its SpeedBar buttons and a hint line in the status bar at the bottom.**

that appears when you rest the mouse cursor on a particular button or other toolbar item for more than a second or two.

Now that you know what elements make up a good help system, you're ready to choose your tools (see the sidebar "Choosing Your Tools") and get to work. With a good design tool and the knowledge you've gained from this article, you should be able to enhance your programs with a thoroughly professional help system. □

NEIL J. RUBENKING IS TECHNICAL EDITOR OF *PC MAGAZINE.*

Toolkits

BY NEIL J. RUBENKING

OutReach Frees VBXs from VB

The feature-rich, high-level custom controls available for Microsoft Visual Basic (VB) have long been the envy of non-VB programmers—but not any more. These controls, commonly called VBXs (after their filename extension), can be used by programs written in other languages with OutReach, Version 1.0, from InterGroup Technologies ($395). The program using the VBX can be a compiled .EXE file or a macro script; the only absolute requirement is that it must be able to call functions in a DLL.

OutReach includes an Object Model Browser, which displays important internal details of VBX controls and records them for use by programs using OutReach. Well-commented examples show how to use OutReach with Microsoft C, Borland C, Borland Pascal, Excel, and FoxPro. You are permitted to distribute OUTREACH .DLL freely with any number of copies of a single application; additional applications require additional licenses.

PROGRAMMING WITH VBXs To incorporate VBXs into a program with OutReach, first use the Object Model Browser to select VBX files and record them in a model definition file. For each control in the selected VBXs, the browser displays the name and data type for each property, and the name, ID number, and parameters for each event, along with other data. This information is essential when writing calls to the OutReach DLL functions.

At start-up, an OutReach-based program creates an OutReach "session" associated with the model definition file stored by the browser. Another OutReach function creates each control and returns a 32-bit handle. Since there's no visual design environment, your program must set the control's size and placement directly. One convenient way to do that is to copy the size and shape of a placeholder static control in the program's resource file. You can also nest controls within an existing control that accepts nesting.

Once a control has been created, you set its properties using functions specific to the data type of the property. It may be convenient to keep a local copy of some properties; OutReach makes that easy by associating a programmer-defined 4-byte value (typically a pointer) with each control. Standard VBX control methods such as Refresh and ZOrder have their own OutReach equivalents.

For most programs, setting up the VBX control properties is only half the job. The program also needs to respond to the control's events. In a compiled programming language like C or Pascal, you simply include the address of a callback function when you create the control. Each time the control generates an event, OutReach calls the callback function. Most OutReach functions are available as callbacks except those that terminate the OutReach session or destroy the control.

Because not all Windows development systems support callback functions, OutReach lets your programs communicate through Windows messages or DDE, or by simulating a mouse click on a specified area of the program's window.

OutReach supports VBX versions 1, 2, and 3 (VBX support in MFC and OWL is version 1 only), with a few minor limitations. The current version doesn't support DDE properties or database-bound controls, though database support is in the works for a later version. Graphical controls (controls with no window handle) aren't supported, nor are those rare controls that ignore runtime property changes. And of course the simple controls contained in VBRUN300.DLL itself are not available.

OutReach won't give you the visual development environment of VB, but it will provide easy access to powerful VBX custom controls in almost any development system.

▶ **OutReach, Version 1.0.** List price: *$199 until December 31, 1994; $395 thereafter.* Requires: *386-based PC or better, 4MB RAM, 2MB hard disk space, DOS 3.3 or later, Microsoft Windows 3.1 or later, development environment that supports DLLs.* InterGroup Technologies Inc., *14205 S.E. 36th St., #100, Bellevue, WA 98006; 206-643-8089; fax, 206-643-6977; CompuServe: 74602,3121; Internet: outreach@world.std.com.*
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OFF THE STACK

• **ImageFX**'s FXTools/VB, Professional Edition ($349) is a multimedia special effects tool for Microsoft Visual Basic that lets you dramatize the display of text, shapes, and bitmapped images by adding wipes, fades, multipass dissolves, and dozens of other special effects. The Professional Edition supports 100 effects (up from 50), and adds sound, video, and 18 different image file formats. *ImageFX; 800-229-8030, 716-272-8030.*
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• **Syware** offers Dr. DeeBee Tools ($749), a suite of seven utilities that track the performance and inner workings of ODBC. The utilities, which can also be purchased separately, include Check (checks syntax of ODBC calls at runtime), Peek (records ODBC calls), Timer (counts and times ODBC calls), Test (runs regression tests on an ODBC driver), Spy (a redistributable version of Peek), Replay (replays logs generated by Spy), and Info (displays characteristics of a driver). *SYWARE Inc.; 617-497-1376.*
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Power Programming

BY RICHARD HALE SHAW

Make Your Apps More Robust

Win32 operating systems, such as Windows NT and Windows 95, have greatly advanced the art of handling runtime errors and exceptions. In these systems, exception handling is built into the infrastructure, used by the operating system itself, and—a boon to programmers—made available to application programs.

Under DOS, the only built-in error-trapping and exception-handling mechanism was interrupt 24h. This is generated whenever a hardware error occurs (such as when a user tries to select a file on a floppy disk drive whose door is left open) or when a software program generates an error (such as attempting to divide a value by zero). In either case, the only way to trap the resulting interrupt is to replace the default interrupt 24h handler (which can write the dreaded "Abort, Retry, Fail" message across even the Windows desktop) with your own. Handling interrupt 24h is delicate. You have to take care not to generate any other exception-prone interrupts, and this makes your error-handling code complex and onerous.

On a Win32 platform, however, exception handling can be simple and elegant. In this article, I'll explain Win32's *structured exception handling* mechanism and how you can take advantage of it in your applications. Finally, I'll also explain the implications of structured exception handling for different language implementations and why you may get differing results when you build your applications with different C/C++ compilers.

THE BASICS Exceptions are events that trigger the execution of code that's outside a program's normal flow of control. If a hardware component fails or if a software program attempts to violate system integrity, Win32 will generate, or *throw*, an exception. You can even have your programs deliberately throw their own exceptions (via the Win32 RaiseException function) to signal an exception condition: This will often make sense when it would be cumbersome to add error-detecting code to the body of your program.

When an exception—either hardware- or software-based—occurs in your Win32 program, the processor will stop executing at that point in your program and transfer control to the system. Win32 will save the machine state of the thread that generated the exception, along with other information describing the exception, and begin to search for an exception handler to handle it. Whether the operating system is successful or not in doing this depends on whether you've installed an exception handler for the piece of code that was executing when the exception was thrown.

Structured exception handling is built into Win32-based operating systems such as Windows 95 and NT. Find out how to use it in your apps.

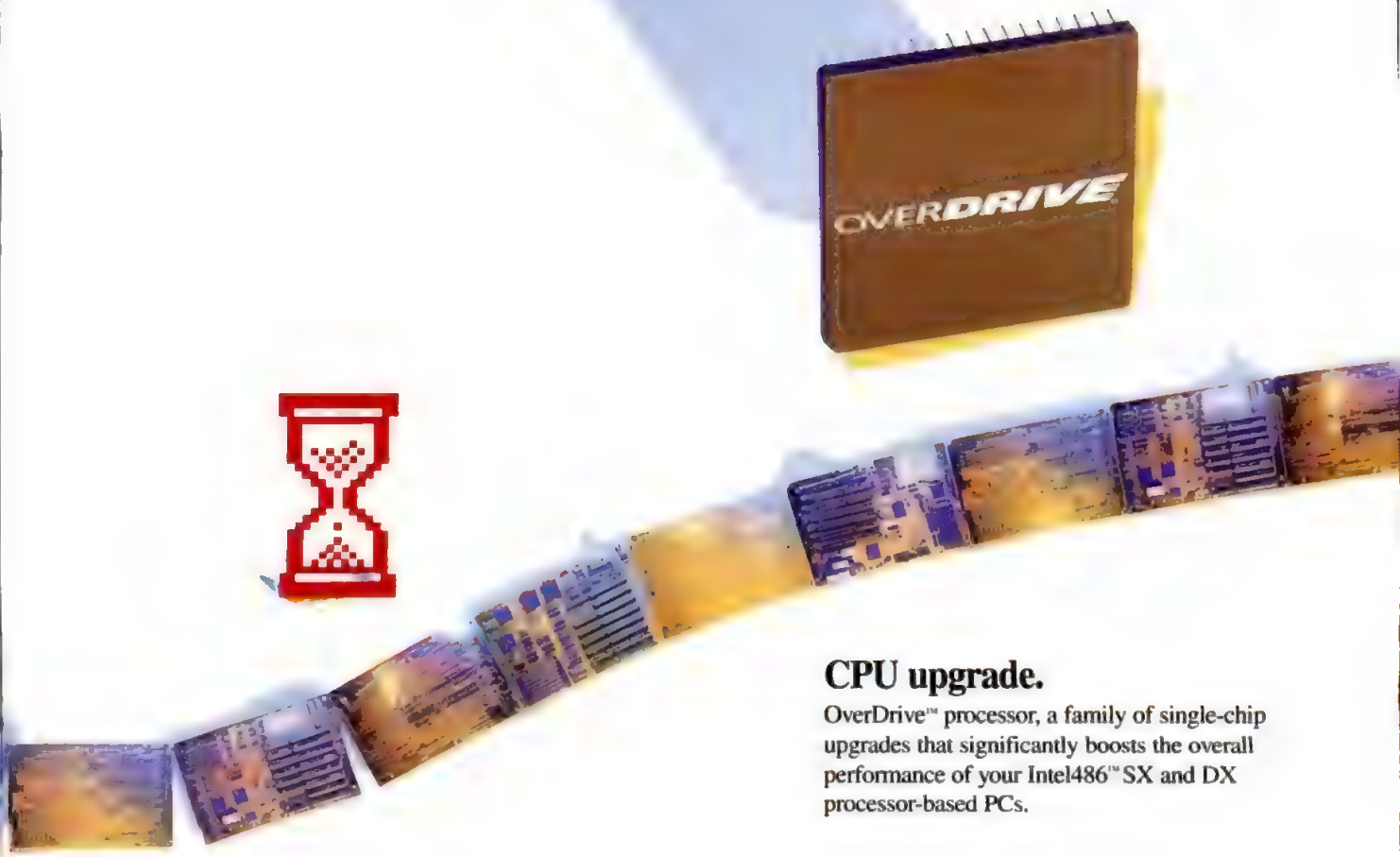
How do you install an exception handler? Not via an API call. Like other Win32 facilities such as virtual memory, heap management, and multithreading, structured exception handling (SEH) is a facility that's built into the underlying operating system but exposed for use by applications. (For an example of how Win32 operating systems use this facility for their own purposes, see the sidebar "Win32 Operating Systems' Own Use of SEH.") Unlike these other facilities, structured exception handling is not exposed to applications via a set of API functions, as such. Using the flat memory architecture of Win32 systems, SEH lets you use extensions to your application development language to establish one or more code frames, each with its own exception handler.

This approach presupposes that your application development language supports SEH. It's the responsibility of each language vendor to implement structured exception handling in a way that makes sense for that application development language. (Microsoft publishes an SEH specification that language vendors can acquire to implement SEH in their Win32 application development environments.)

Consequently, all Win32 structured exception handling code will not look the same: Once it's been implemented in Visual Basic, Borland Pascal, or even xBASE, for example, it could be quite different from the examples you might find for C++. Fortunately for C/C++ developers, the three major C/C++ compiler vendors—Borland, Microsoft, and Symantec—have used what is essentially the same model and syntax for their SEH support (although the implementations may differ in how they perform their tasks).

There are two key steps to take when you use structured exception handling in a Win32 application. First, you have to identify the portion of your code that you want to protect in the event that an exception occurs. This section, known as the *guarded* body, contains code in which one or more exceptions could occur. Second, you must define an exception handler for each guarded body.

Let's use Microsoft C/C++ syntax as an example. You use two new keywords, __try and __except, to define a guarded body and its associated exception handler in your program. Here's how this syntax works:



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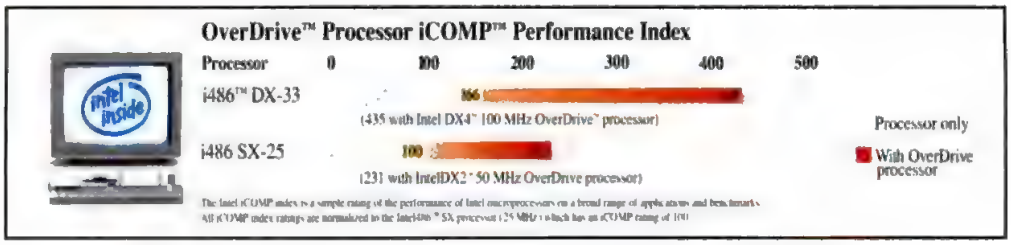

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```
#include<windows.h>

int WinMain(HINSTANCE, HINSTANCE, LPSTR, int)
{
__try
        {
        // entire application code goes here...
        char *p = NULL;             // set up NULL pointer...
        *p = 0;                     // generate an exception with it
        }
__except(EXCEPTION_EXECUTE_HANDLER)
        {
        MessageBox(NULL,
                "Unhandled Exception in WinMain...press Ok to terminate!",
                "MyApplication", MB_ICONEXCLAMATION);
        }
}
```

Figure 1: **This code sets up a catchall, general-purpose exception handler in WinMain.**

```
__try
   {
   ... // guarded body
   }
__except(filter_expression)
   {
   ... // body of exception handler
   }
```

Here, the guarded body is defined inside of a __try block; you enclose the accompanying exception handler in an __except block that immediately follows. The *filter expression,* which is always placed inside the parenthesis of the __except statement, provides a program with a chance to interpret the nature of the exception that occurred and determine the best course of action.

Note that the SEH keywords, __try and __except, are similar to the keywords `try` and `catch` used in C++ exception handling. In Win32, the system throws an exception; C++, on the other hand, adds a keyword for this: `throw`. There are a number of other differences between Win32 SEH and C++ exceptions. C++'s `try`, `catch`, and `throw` are formal additions to the C++ language, whereas __try and __except are implementation-specific additions and consequently use one or more underscore (_) characters, as required by the ANSI C standard. I'll describe more differences later on.

AN EXCEPTION-HANDLING FUNCTION

Let's put this into practice with the classic example for using SEH: the C strcpy() function:

```
char *strcpy(char *dest,
             char *source);
```

Traditionally, strcpy() takes two pointers as function arguments and copies data from the address pointed to by the second pointer into the address pointed to by the first pointer; the function returns the destination parameter if it succeeds or NULL if it fails.

The strcpy() function makes two assumptions:

- that the source parameter points to a NULL-terminated string, and
- that the first or destination parameter points to a location that's big enough to hold the data pointed to by the source.

If either assumption is wrong, you're likely to get a memory access violation under Win32. For example, if the second parameter isn't NULL-terminated, then the function will run beyond the data pointed to by the source until it either locates a NULL in some other piece of data or reaches the end of addressable memory. In the first case, Win32 will probably throw an access violation exception for copying too much data and overwriting memory. In the second case, you'll certainly get such a violation. If this happens and you don't have an exception handler installed, Win32 will terminate your application.

How can you use SEH to prevent this? By wrapping the strcpy() function itself in an exception-handling function and using that function instead; for example,

```
LPTSTR SafeStrCpy(LPTSTR String1,
                  LPTSTR String2)
{
__try
   {
   return strcpy(String1, String2);
   }
__except((GetExceptionCode() ==
         EXCEPTION_ACCESS_VIOLATION) ?
         EXCEPTION_EXECUTE_HANDLER :
         EXCEPTION_CONTINUE_SEARCH)
      {
   return NULL;
      }
}
```

SafeStrCpy() is a drop-in substitute for strcpy(). It takes two Win32 pointers as parameters and passes them directly to strcpy(). It uses a __try block to protect against exceptions occurring during the call to strcpy(); if the system throws an exception, execution will jump to the code in the filter expression:

```
((GetExceptionCode() ==
  EXCEPTION_ACCESS_VIOLATION) ?
 EXCEPTION_EXECUTE_HANDLER :
 EXCEPTION_CONTINUE_SEARCH)
```

The pseudocode for this C/C++ ternary expression would be

```
If GetExceptionCode returns
 EXCEPTION_ACCESS_VIOLATION
   return EXCEPTION_EXECUTE_HANDLER
Else
   return EXCEPTION_CONTINUE_SEARCH
```

This filter expression calls Win32's GetExceptionCode() function to determine what type of exception occurred. This function can return one of a number of predefined system exception values, or it can return a value representing an application-defined exception value.

If an access violation occurred, GetExceptionCode() will return EXCEPTION_ACCESS_VIOLATION and then the result of the expression will be EXCEPTION_EXECUTE_HANDLER. The latter is one of three values—EXCEPTION_EXECUTE_HANDLER, EXCEPTION_CONTINUE_SEARCH, or EXCEPTION_CONTINUE_EXECUTION—that can be returned by a filter expression to determine the course of the program.

Your filter expression should return EXCEPTION_EXECUTE_HANDLER if you want Win32 to execute the exception handler. In the example, the exception handler will cause the function to return NULL; even if an access violation

occurs, the caller will get a NULL as the function's return value and the application won't crash. Thus, SafeStrCpy() provides a "safe" alternative to strcpy(), and an application using it can recover gracefully from an access violation inside it—provided the application checks the function's return value!

NESTING EXCEPTION HANDLERS Win32's exception mechanism is both thread- and frame-based: Each exception handler you install is in place at the stack frame location of the thread for which you installed it. You can install a number of exception handlers and nest them. For instance, you can install one inside the guarded body of the other:

```
__try
    {
    ... // outer guarded body
    __try
        {
        ... // inner guarded body
        }
    __except(filter_expression)
        {
        ... // inner exception handler
        }
    }
__except(filter_expression)
    {
    ... // outer exception handler
    }
```

If an exception occurs inside the second or inner __try, the inner __except will interpret (and potentially handle) the exception; if an exception occurs inside the first __try but outside of the second __try, the outer __except will be triggered.

Alternatively, you can nest exception handlers inside of functions that call one another:

```
void Test2(void)
{
__try
        {
        ... // guarded body
        }
__except(filter_expression)
        {
        ... // exception handler
        }
}
void Test(void)
{
__try
        {
        ...
        Test2();
        }
__except(...)
        {
        ... // exception handler
        }
}
```

Here, the Test function calls Test2. If an exception occurs in Test2, its own __except statement will be invoked; if an exception occurs anywhere in Test's __try block but not inside of the call to Test2, then Test's __except will be invoked.

Figure 2: **This message box is displayed by a general-purpose exception handler.**

But what happens in either of these cases if the inner exception handler fails or refuses to handle the exception?

There are several ways that this can happen. First, if an exception handler fails to handle an exception correctly, the system will search for another, previously installed exception handler that can handle the exception. Or, if the inner exception handler only handles a particular type of exception, it might return EXCEPTION_CONTINUE_SEARCH from its filter expression: This enjoins the system to continue to search for a handler that can handle the thrown exception. (Your filter expression should return the value EXCEPTION_CONTINUE_SEARCH whenever it doesn't recognize an exception code or your exception handler won't handle that particular exception.)

An exception handler may try to resume execution after a nonresumable exception. Some exceptions are *resumable*, or continuable; that is, the system will let the program fix the exception and resume execution at the point at which an exception occurred. (This is exactly how Win32's virtual memory manager knows when to swap in a block of previously swapped-out memory, as described in the sidebar.) Your filter expression can return EXCEPTION_CONTINUE_EXECUTION when it encounters a resumable exception, but you'll have to fix the problem in the filter expression first. If your filter expression returns EXCEPTION_CONTINUE_EXECUTION after a nonresumable exception, or fails to fix the problem before resuming execution of a resumable exception, the system will again search for a previously installed handler to handle the exception.

In any of these cases, control will eventually go to an earlier exception handler—one that's been previously installed in the current stack frame. In the example above, this was the outer exception handler. If an exception handler fails or refuses to handle an exception, Win32 works its way back up through each previously installed exception handler, looking for one that will handle the exception.

What happens if you don't have an exception handler installed? Win32 installs a default exception handler at the base of each application thread, so even if you have multiple threads, this default exception handler will be triggered when an unhandled exception occurs. You can grab control of this default exception handler by installing a catchall exception handler in your application's WinMain (see Figure 1), or around the thread function of each thread, or both. For example, if an unhandled exception occurs in the __try block of Figure 1, this code will produce the message box shown in Figure 2.

Without this code—or its equivalent—wrapped around the code inside your application's WinMain (and preferably around the guts of each thread function), Win32 will display its own default exception handler instead. Take a moment to study Figure 3, which shows the default

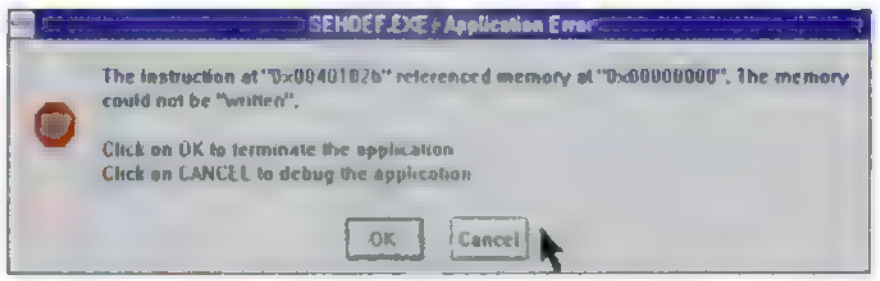

Figure 3: **This is Windows NT's default exception-handling dialog box.**

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exception-handler dialog used by Windows NT: Do you really want a user to be able to press Cancel to invoke the debugger? (If you don't believe this happens, type in the code in Figure 1, change EXCEPTION_EXECUTE_HANDLER to EXCEPTION_CONTINUE_SEARCH, and then compile and run the program: You'll see what I mean.) I'll explain the implications of letting the user press the Cancel button, as shown in this figure, in a moment.

USING A FILTER FUNCTION In the __except statement of an exception handler, the filter expression can be any legal C or C++ expression—including a function call. Since the purpose of the filter expression is to evaluate the exception that occurred and give your program a chance to react intelligently to it, it often makes sense to use a filter function—a function that's used as a filter expression—instead of a single expression. The value of the filter expression or the return value of a filter function determines what happens next.

Although you can often use a simple filter expression (as in the earlier examples) to evaluate the exception, using a filter function lets you inject more complex decision making into the evaluation process. For example, the __except statement in SafeStrCopy was fairly primitive. In another context, it might not be enough. You might want to make other decisions based on the type of exception that occurred (there are over a dozen different types of exceptions that a Win32 system can throw). Or you might want to use Win32's GetExceptionInformation() function, which returns detailed information about the exception (such as the virtual address where the exception occurred), and determine your exception-handling strategy based on its results. In other words, using a filter expression alone might not be enough.

But because Win32 SEH is frame-based, and because a stack frame may have been overwritten at the time an exception was thrown, Win32 has to provide you with a "safe place" to evaluate the exception and decide what to do. Consequently, if you use a filter function as your filter expression, it will execute in a safe stack frame, one that cannot have been corrupted by the exception that was thrown. Because a filter function executes in this safe stack frame, you'll need to pass it information from Win32 exception functions when you call the filter function. These functions are context-dependent, and they have to be called from the stack frame where the exception occurred—from the filter expression where the filter function is called—rather than from inside the filter function, in order to return valid information.

For example:

```
int FilterFunction(void)
  {
  ...
  DWORD code = GetExceptionCode();
  // bad move!
```

```
// sehdump.cpp RHS 8/12/94

#include<windows.h>
#include<string.h>
#include<excpt.h>
#include<stdio.h>

const MAX_EXCEPTIONS = 21;
struct _ExceptionCodeNames
  {
    char *name;
    DWORD code;
    } ExceptionCodeNames[MAX_EXCEPTIONS] =
{
    {"Access Violation", EXCEPTION_ACCESS_VIOLATION },
    {"Datatype Misalignment", EXCEPTION_DATATYPE_MISALIGNMENT },
    {"Breakpoint",EXCEPTION_BREAKPOINT },
    {"Single Step", EXCEPTION_SINGLE_STEP },
    {"Array Bounds Exceeded", EXCEPTION_ARRAY_BOUNDS_EXCEEDED },
    {"Floating Point: denormal Operand",
     EXCEPTION_FLT_DENORMAL_OPERAND },
    {"Floating Point: divide by Zero", EXCEPTION_FLT_DIVIDE_BY_ZERO },
    {"Floating Point: inexact Result", EXCEPTION_FLT_INEXACT_RESULT },
    {"Floating Point: invalid operation",
     EXCEPTION_FLT_INVALID_OPERATION },
    {"Floating Point: overflow", EXCEPTION_FLT_OVERFLOW },
    {"Floating Point: Stack Check", EXCEPTION_FLT_STACK_CHECK },
    {"Floating Point: Underflow", EXCEPTION_FLT_UNDERFLOW },
    {"Integer divide by zero", EXCEPTION_INT_DIVIDE_BY_ZERO },
    {"Integer overflow", EXCEPTION_INT_OVERFLOW },
    {"Privileged Instruction", EXCEPTION_PRIV_INSTRUCTION },
  {"In page error", EXCEPTION_IN_PAGE_ERROR },
  {"Illegal Instruction", EXCEPTION_ILLEGAL_INSTRUCTION },
  {"Non-continuable Exception", EXCEPTION_NONCONTINUABLE_EXCEPTION },
  {"Stack Overflow", EXCEPTION_STACK_OVERFLOW },
  {"Invalid Disposition", EXCEPTION_INVALID_DISPOSITION },
  {"Guard Page", EXCEPTION_GUARD_PAGE }
  };

char *GetExceptionCodeName(DWORD code)
    {
    for(int i = 0; i < MAX_EXCEPTIONS; i++)
        if(code == ExceptionCodeNames[i].code)
           return ExceptionCodeNames[i].name;
    return "";
    }

void PrintExceptionInfo(LPEXCEPTION_POINTERS myInfo)
    {
    EXCEPTION_RECORD er = *(myInfo->ExceptionRecord);    // struct
assign
while(TRUE)
  {
  char exceptiontype[30];
  if(er.ExceptionCode == EXCEPTION_ACCESS_VIOLATION)
    sprintf(exceptiontype,"%s violation",
      (er.ExceptionInformation[0] == 0) ? "read" : "write");
  else
    exceptiontype[0] = '\0';

  char buf[150];
  sprintf(buf,
          "%s Exception: %s @ address 0x%lp (exception code 0x%08x)"
          ", %scontinuable",
    GetExceptionCodeName(er.ExceptionCode),
    exceptiontype,
    er.ExceptionAddress,
      er.ExceptionCode,
      (er.ExceptionFlags == 0) ? "" : "NON-");
  MessageBox(NULL,buf,GetCommandLine(),MB_ICONEXCLAMATION);

  if(er.ExceptionRecord)
      er = *er.ExceptionRecord;
    else
      break;
    }
  }


DWORD FilterFunction(LPEXCEPTION_POINTERS Info)
    {
  PrintExceptionInfo(Info);
    return EXCEPTION_EXECUTE_HANDLER;
    }

int WINAPI WinMain(HANDLE, HANDLE, LPSTR, int)
    {
    __try
      {
    char *p = NULL;
         *p = 'a';    // trigger exception by writing to NULL pointer
                      // this line never executed
        }
      __except(FilterFunction(GetExceptionInformation()))
          {

          // insert exception handling here...

          }
    return 0;
    }
```

Figure 4: **The SEHDUMP program can display exception information in a message box.**

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```
    // don't do this!!
    LPEXCEPTION_POINTERS lpException =
    GetExceptionInformation();
    ...
  }
__try
  {
    ...
  }
__except(FilterFunction())
  {
  ... // handle exception here
  }
```

Here the filter function calls GetExceptionCode() and GetExceptionInformation()—a bad move,because these functions won't return exception information pertaining to the stack frame where the exception occurred.

On the other hand,

```
int FilterFunction(DWORD code,
LPEXCEPTION_POINTERS lpException-
Pointers)
        {
        ...
        }
__try
        {
        ...
        }
__except(FilterFunction(GetException-
Code(), GetExceptionInformation())
        {
        ... // handle exception here
        }
```

will work. Both exception information functions are called from the filter expression's stack frame, which is where the exception was thrown. You won't have to worry about calling these functions in that stack frame: Win32 guarantees the safety of this approach. However, you should avoid calling other functions to pass information to a filter function, and only pass such a function the address of nonstack objects such as globals or statics.

INTERPRETING EXCEPTIONS When an exception is thrown, Win32 saves information about the machine state of the thread where the exception occurred, along with information about the exception itself. This information is stored in two structures: a CONTEXT structure and an EXCEPTION_RECORD structure. The CONTEXT structure will vary with the underlying machine architecture: It contains members for each register plus a special member to retain information about the floating-point registers. EXCEPTION_RECORD structures, however, have a fixed format, and the EXCEPTION_ RECORD (as well as the CONTEXT structure) for a Win32 exception can be retrieved by calling the GetExceptionInformation() function:

```
EXCEPTION_POINTERS* GetException-
Information(void);
```

This function will return a pointer to an EXCEPTION_POINTERS structure, which contains both a pointer to the CONTEXT structure and a pointer to the EXCEPTION_RECORD structure containing the saved information:

```
int typedef struct _EXCEPTION_POINTERS
  {
  PEXCEPTION_RECORD ExceptionRecord;
  PCONTEXT ContextRecord;
  } EXCEPTION_POINTERS;
```

If you're willing to learn which machine registers contain what information, you can examine the CONTEXT structure. But more important, you can use the pointer to the EXCEPTION_RECORD to retrieve the exception code and the virtual address at which the exception occurred:

```
typedef struct _EXCEPTION_RECORD
  {
  DWORD ExceptionCode;
  DWORD ExceptionFlags;
  struct _EXCEPTION_RECORD
        *ExceptionRecord;
  PVOID ExceptionAddress;
  DWORD NumberParameters;
  DWORD ExceptionInformation[EX-
        CEPTION_MAXIMUM_PARAMETERS];
  } EXCEPTION_RECORD;
```

Additionally, this structure contains a flag that indicates whether the exception is resumable and a pointer to another exception record in the event that nested exceptions have been thrown. The last two members of the structure are reserved for specifying parameters when an application throws its own exceptions. Figure 4 shows an example of a program that displays exception information retrieved via GetExceptionInformation(); the output of the program is shown in Figure 5.

Figure 5: **This is the output of the SEHDUMP program, which displays exception information.**

ANATOMY OF AN EXCEPTION When an exception occurs, a complex sequence of events ensues; I'll just summarize it here. First, as I mentioned above, the processor turns over control to the system, which saves the machine state and exception information in the CONTEXT and EXCEPTION_RECORD structures. The discussion that follows applies if the exception was generated by a program running in User mode rather than a system component running in Kernel or Privileged mode.

If the program is being debugged, the system will notify the debugger. There are two reasons for this: If an exception occurs during a debugging session, this lets the debugger gain control and report the exception. It also lets a debugger gain control by deliberately generating an exception. As a means of setting breakpoints or watchpoints during a debugging session, a debugger can insert illegal instructions into a program's executable image in memory. The debugger inserts these instructions at the point in the program where a developer wants a breakpoint to take effect. When the processor encounters such an instruction, it generates an exception, the system turns over control to the debugger, and the debugger removes the offending instruction to handle the exception—and now it's able to interact with the developer again!

If the program isn't being debugged (or the debugger doesn't handle the exception), the system starts searching for an exception handler in the stack frame where the exception occurred. If it fails to find an exception handler there, it will search the previous stack frame—and so on. If the system finds an exception handler, the application gets the opportunity to fix and handle the exception. Provided

Win32 Operating Systems' Own Use of SEH

By Richard Hale Shaw

Like other operating system specifications, Microsoft's Win32 API has a "philosophy," and one of its principles is to expose a number of system-level features and facilities for use at the application level. On Win32 platforms, these features and facilities include the virtual memory API functions, the heap management functions, memory-mapped files, and structured exception handling (SEH). (For a refresher course on the basics of Win32, see the Power Programming column "An Introduction to the Win32 API," April 26, 1994.) SEH, like these others, is available for use by applications, but it is also used all the time in the underlying operating system.

For example, SEH is built into Win32 operating systems such as Windows NT and Windows 95. Using SEH, a Win32 system can support demand-paged virtual memory. On a Win32 system, every application gets a 2-gigabyte virtual address space in which the program's executable, its DLLs, and all data is stored. Since only a fraction of this address space is typically available on a target machine, the operating system will map only a portion of an application's virtual address space into physical addresses at any one time. The balance of the virtual address space that's actually used by the application is written to the system paging or swap file. (Win32 systems do not, however, store EXEs and DLLs in the swap file, but simply reread them from their original disk-based images.)

With only a portion of the application's address space stored in physical memory at any one time, how does Win32 ensure that the appropriate memory blocks are read back into physical RAM from the paging file when the application needs them? The answer: structured exception handling.

Whenever a Win32 application attempts to read or write a memory address, the address is examined by the system's virtual memory manager (VMM). The VMM maintains a table that correlates an application's virtual addresses with the physical location of that memory, so it can translate a virtual address into a physical one and vice versa. The VMM can move memory pages around, swap them to disk, or discard them altogether if it needs additional physical memory. When it moves or reloads a page of physical memory, it simply remaps that page's virtual addresses to a new set of physical addresses.

Under Win32, any attempt by a program to access a virtual address that's not in physical RAM will generate an access violation exception. In such a case, the system's exception handler will examine the exception and determine that the trouble was caused because the virtual page that contains the desired address was not loaded into physical memory. If available physical memory is already in short supply, the system's exception handler will first discard some memory or write it to disk and then load the desired memory page back into memory.

Since the newly loaded page will most likely occupy a physical RAM address that's different from the one it previously resided in, the system exception handler will call on the VMM to remap the new physical page to the newly restored virtual page. Thus, the data contained in the memory block will continue to occupy the same set of virtual addresses as it did previously. At this point, the system exception handler will cause the application to resume execution at the point where it was attempting to read from or write to a memory address. Best of all: The entire process is extremely fast and completely transparent to the application performing the memory read or write.

Thus, SEH is simply a facility that's built into a Win32 operating system, but which Win32 exposes for use in an application. And that means that you can incorporate SEH into your own programs just as easily as Microsoft's Win32 teams use it inside of Windows NT or Windows 95. □

the application does so and the exception is resumable, the program's exception handler can tell the system to resume execution. The machine state and context are restored from the previously saved structures, and the program resumes as if nothing ever happened.

If the exception handler fails to handle the exception, the system will continue to search the program's stack frames for a handler that does handle the exception. If the system fails to find a capable handler and the program is being debugged, the system will again notify the debugger: This is the debugger's second chance to handle the exception. Indeed, even if the program is not being debugged, you can still invoke the debugger. When the system fails to find an appropriate exception handler for a program that's not being debugged, it invokes its default handler—which displays the dialog shown in Figure 3. The system will also call this default handler if the debugger doesn't use its second chance to handle the exception.

Ultimately, if your program fails to handle the exception, and if the user declines to invoke the debugger that's installed, Win32 will terminate the application.

What happens when the exception is generated by a system component running in Kernel or Privileged mode? This is more serious, of course. In this case, the system will also search for an exception handler. But if an exception handler cannot be located to handle the exception or if an exception handler fails to handle the exception, the system is shut down. You might as well have selected File|Exit from the Program Manager menu and ended the Windows session.

If you've worked with Windows NT much, you've already seen the result of liberal use of structured exception handling: a nearly crash-proof system. Windows NT doesn't go down, because all the exceptions already turned up during test-

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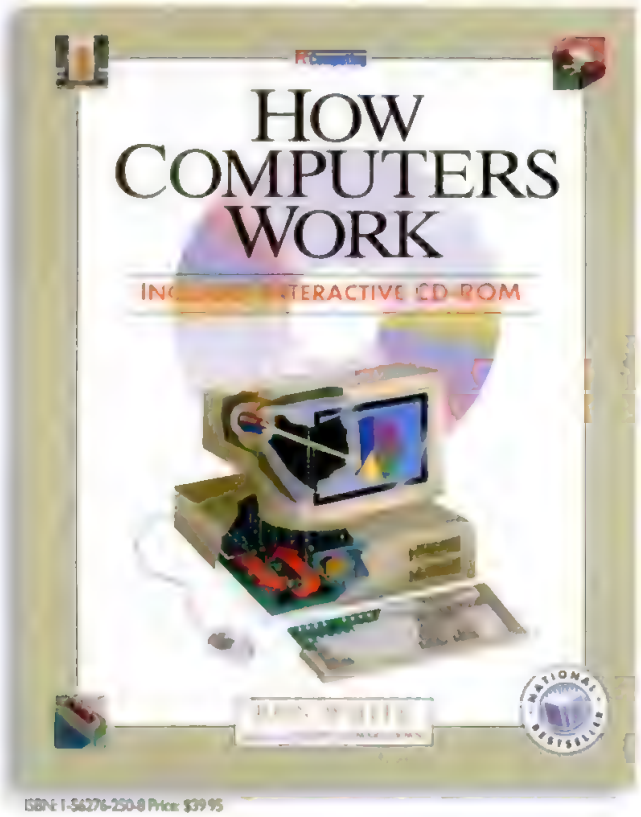

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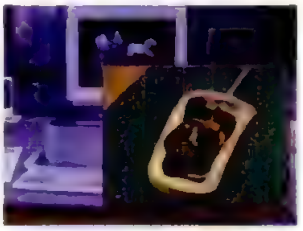

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ing—before the operating system was released.

C++ EXCEPTIONS VS. WIN32 SEH Finally, I'd like to clear up a few misconceptions. While both C++ and Win32 offer exception handling, there are some important differences. First, Win32 SEH is implemented by the operating system, so there's a systemwide control that's not available through language extensions such as those implemented by C++. You simply cannot trap the most serious exceptions with C++ exception handling, as you can with Win32 SEH. Second, C++ exception handling is nonresumptive; Win32 SEH does provide for program resumption with some types of exceptions.

C++'s exception model requires that *you* throw the exceptions when something goes wrong, and that presupposes that your program is in a state in which program logic can detect that something has indeed gone wrong. With Win32 SEH, you can construct an exception handler that puts you in a safe position to evaluate what went wrong if—and only if—an exception occurs.

Also, beware when using C++ with SEH: The original Borland and Microsoft implementations didn't properly destruct objects constructed inside of the __try block if an exception caused program flow to leave the __try block abnormally. Users of Microsoft's new Visual C++ 2.0 will find that Win32 exceptions and C++ exceptions have been blended in that product: Your objects will be properly destructed—even if exception handling takes program flow way back to a previous stack frame.

EXCEPTIONAL PLATFORMS Unlike DOS or 16-bit Windows 3.*x*, 32-bit operating systems like Windows NT or Windows 95 aren't just sophisticated program launchers. They are, instead, comprehensive application development and deployment platforms. And provided that you take advantage of the more advanced services they offer, you can write far more complex, efficient, and robust applications than were possible under DOS or Windows 3.1. Win32 SEH makes exception handling elegant and easy to use. □

RICHARD HALE SHAW IS A CONTRIBUTING EDITOR OF *PC MAGAZINE*.

Utilities

BY DOUGLAS BOLING

Turn, Turn, Turn. . .Schedule!

"For every thing there is a season, and a time for every purpose under heaven." The problem is remembering it! From the simple wristwatch to the most complicated personal information manager, people spend big bucks on devices that are supposed to help them keep track of what to do when. But most of these products only beep to remind us about a task. Why shouldn't the computer just do the darn task and tell us later? Well, now it can.

Scheduler, this issue's utility, is a Microsoft Windows program providing a simple but powerful service: It will run programs on a schedule you provide. Programs can be scheduled to run in one of four ways:

- once—up to years in the future;
- at specified intervals—from every minute to once a day;
- by day of the week—every Monday, Wednesday, and Friday for example; or
- by day of the month—such as the 1st and 15th of every month.

You can define up to 32 different programs to run on a schedule you set.

Scheduler will run a program complete with a set of command line parameters you provide. The working directory of the program can be specified for each program being run. You can even specify if the program should start as a window or an icon.

Scheduler provides a simple but powerful service: It will run programs on a schedule you provide.

If you think it is time for this new *PC Magazine* utility, simply schedule a download from *PC Magazine*'s PC MagNet. (For details, see the sidebar "Guide to Our Utilities & How to Get Them.") For the programmers among you, the C source and other necessary files are provided. Scheduler was written in Microsoft C, Version 6.0, and should work with any Microsoft C or compatible compiler. Make files are provided for the Microsoft C 6.0 and Borland C++ 3.1 compilers.

USING SCHEDULER Scheduler is simple to install and use. The program name, in deference to limitations on CompuServe, has been shortened to SCHED. Just copy SCHED.EXE into a directory on your hard disk. Next, create an icon for Scheduler in your Startup group in Program Manager. This ensures that Scheduler will run every time you start Windows. As useful as Scheduler may be, it can't start programs when it's not running!

Start Scheduler by double-clicking on its icon in the Startup group. You will see a dialog box with an empty list and a column of buttons down the right side of the window. Clicking on the top button, Add, will display the Schedule Program dialog box, which lets you add programs to Scheduler.

The dialog box is broken into three main sections: Event Type, Event Details, and Program Details. The first section, Event Type, is a group of radio buttons (or option buttons) that select events categorized according to when they occur: at one specified time, or at several times, or on a fixed day each week, or on a fixed date each month. The second section allows you to provide details for the event being scheduled; the fields change depending upon the type of event you select. The third section gives Scheduler information about the program it will be launching.

If you want a program to run once, all you have to do is enter the time and date of the event. The date should be entered in a *mm-dd-yy* format. You can enter a date up to the year 2079, a long enough delay for even the most procrastinating of users. Years past 1999 are entered with the last two digits like any other year. For example, February 3, 2019, would be entered as 2-3-19. The time is entered in an *hh:mm* AM|PM format. Midnight is 0:0, while noon is 12:00 PM. To run a program at 1:23 P.M. on September 19, 1996, the time would be entered as 1:23 PM and the date as 9-19-96.

The Recurring event type lets you run a program at regular intervals each day starting at a given time of day. This event has two entry fields: Interval and Starting Time. The first is the length of time between events, in hours and minutes; and the second is the time of day that the event should first occur. For example, to run a program every 15 minutes every day beginning at 7:30 A.M., the two fields, Interval and Starting Time, should be entered as 0:15 and 7:30.

The days-of-the-week event type lets you schedule a program to run on partic-

Top 10 Utilities

Rank	Utility
1	**MYGRPS** - *Customizes group icons*
2	**WPNTR** - *Highlights Windows presentations*
3	**WINCMD** - *Command file interpreter*
4	**WTIME** - *Keeps PC clock accurate*
5	**FINDIR** - *IRQ line analysis*
6	**MONTOR** - *Monitors system resources*
7	**BAT2EX** - *Compiles batch files*
8	**INCTRL** - *Controls Windows installation*
9	**BUGS** - *Windows 3.1 screensaver*
10	**CONFIX** - *Issues commands at boot time*

This list is based on the total number of downloads each utility has had on PC MagNet over the past month. To download these files, type GO ZNT:TIPS. For more information, see the sidebar "Guide to our Utilities & How to Get Them."

ular days of the week. Its details section contains two controls: a list box containing the names of the days of the week and the now-familiar Starting Time field. You can select more than one day of the week. As with all the other types of events, the Time field is the time of day, in *hh:mm* format, that the program is to start. For example, to have a program run at 2:30 in the afternoon on every Monday, Wednesday, and Friday, you should highlight the Monday, Wednesday, and Friday entries in the list box, and enter 2:30 PM in the Starting Time field.

The days-of-the-month event type is similar to the days-of-the-week event type. But instead of the days of the week, the list box contains the days of the month, from 1 to 31. You can select more than one day. If the 31st is selected, the program will only run in months that have 31 days. To schedule a program to run on the 1st and 15th days of the month, you would highlight the 1 and the 15 in the list box and enter a starting time in *hh:mm* format in the Time field.

The last section of the Schedule Program dialog, the Program Details section, is where you specify the program to run, the working directory for the program, and whether the program should be started as an icon. The Command line and Working Directory fields are self-explanatory. If you don't specify a path to the program, Windows will use its standard search pattern, looking in the current directory, the Windows and system directories, and then the directories in the PATH. Command line parameters can be specified after the program name. To assist in finding the proper program, a Browse button displays a file-browse dialog box.

The check box "Run minimized" lets you specify that the program be run in the background as an icon to avoid cluttering up your desktop. This is probably how you will want most of your scheduled programs to run. Having a scheduled application launch and grab focus while you're in the middle of editing a file would not be very helpful.

Once you've filled in all the details, clicking on the OK button causes Scheduler to check the data you've entered and, if the data is valid, schedule the event. Valid values must be entered in the time and date fields, and the command field must contain a valid path and program name. Clicking on the Cancel button will discard the data entered. In either case, the Schedule Program dialog is removed and you are returned to the main Scheduler window. If you clicked on the OK button, you should see the newly added event listed in the window. The new item will be listed with the type of event and the name of the program to be run.

You can edit or delete an item by highlighting it and using the buttons on the Scheduler window. You can also edit an item by double-clicking on it. When an item is edited, a dialog box similar to the Schedule Program dialog is presented with the current values of the fields filled in. After making changes, you can save the data by clicking on the Save button. The Cancel button discards any changes you have made.

When Scheduler determines it is time to run a scheduled program, it first checks the Working Directory field. If no working directory is specified, the directory remains unchanged; otherwise, the current directory is changed to the working directory. The program is then executed in the mode determined by the "Run minimized" check box. When run as a minimized application, the program's icon will appear on the desktop. Otherwise, the program's window will be launched in the foreground, grabbing focus on the desktop.

While Scheduler does not overtly list complex timing such as the third Sunday in the month or the fourth Thursday in November, there are ways to schedule this type of event. Just use a Windows batch language such as WinBatch or my own WINCMD utility to make the more complex computations. For example, to have a program launch on the second Sunday of a month, just schedule a WINCMD program to run every Sunday. The WINCMD program would then see if the day of the month is between the 8th and the 14th. If so, it would launch the program you want to run on the second Sunday.

INSIDE SCHEDULER While Scheduler is a fairly typical Windows application, it uses a dialog box as its main window instead of using a standard resizable window. The main advantage of using a dialog box is that all the child window controls for the main window can be specified in a dialog template and are automatically created by Windows when it creates the dialog box. This simplifies the Scheduler code since the main window procedure does not have to include a CreateWindow() call for each child in the main window. The maintenance of the main window is also simplified because changes in the position of the controls can be handled by modifying the resource file instead of modifying the main C program.

One advantage Scheduler has over other typical Windows applications is that it uses a dialog box as its main window instead of a standard resizable window.

Although many steps are the same, there are also a few differences in how the main window is created and in the window procedure. First the window class is registered, next the window is created, and then a message loop is entered. The task of registering the window class is the same for both the standard main window and a dialog box main window.

If this is the only instance of the program, the WINCLASS structure is filled with data about the class and the RegisterClass() function is called. The name of the class specified in the WINCLASS structure must match the class name in the template for the dialog box contained in the resource file. While not generally used when defining a typical modal dialog box, the CLASS resource keyword is used to define the name of the class for this dialog. Figure 1 contains the dialog box template for the main window dialog box in Scheduler.

Once the window class is registered, the dialog box can be created. Instead of using the standard CreateWindow() call, the main window is created with a Create-

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```
//-----------------------------------------------------------
// Main Window Dialog template
//-----------------------------------------------------------
sched DIALOG 23, 20, 180, 95
CLASS "sched"
CAPTION "Scheduler"
STYLE DS_MODALFRAME | WS_CAPTION | WS_SYSMENU | WS_MINIMIZEBOX
FONT 8, "Helv"
BEGIN
   ICON  "schedIcon",                  -1,   5,   5,  32,  32
   LISTBOX                   IDD_PROGLIST,   5,   5, 125,  85, LBS_USETABSTOPS
   DEFPUSHBUTTON "&Add",          IDD_ADD, 135,   5,  40,  15
   PUSHBUTTON "&Delete",          IDD_DEL, 135,  23,  40,  15
   PUSHBUTTON "&Edit",           IDD_EDIT, 135,  41,  40,  15
   PUSHBUTTON "A&bout",         IDD_ABOUT, 135,  59,  40,  15
   PUSHBUTTON "E&xit",           IDD_EXIT, 135,  77,  40,  15
END
```

Figure 1: **This is the code for the dialog box template used for the main window dialog box in Scheduler. Its name "Sched" is used as the second parameter to the CreateDialog() function.**

Dialog() call. The line from Scheduler that calls CreateDialog() looks like this:

```
hMain = CreateDialog (hInstance,
 szAppName, NULL, NULL);
```

The first parameter to CreateDialog() is the Instance handle of the program. The second parameter is the name of the dialog template. In this case, szAppName has been assigned "sched" earlier in the code. This string matches the name of the dialog template in the SCHED.RC resource file. In Figure 1, this name is listed on the DIALOG line in the template. The third parameter is the handle of the owner window of the dialog. In this case, the value passed is NULL indicating that the window has no owner.

The final parameter is the address of the message handler procedure for the dialog box. Normally this value is created by calling MakeProcInstance() with the address of the dialog box handler procedure. In our case, this address was specified when the sched class was registered with RegisterClass(). So, instead of passing a procedure address, a NULL value is passed.

There are also differences in the window procedure for a dialog box main window. Unlike standard dialog boxes, when you use a dialog as a main window, the window procedure does not receive a WM_INITDIALOG message. To complicate matters further, the child windows are not created when the procedure receives the WM_CREATE message. To initialize the child window controls, Scheduler uses the WM_SIZE message. Even though our dialog box is not sizable, Windows sends one WM_SIZE message to the window procedure after the window is created and, conveniently for us, just after the child windows have been created.

Unlike the window procedure for a standard window, any messages not handled by our procedure must be passed on to the DefDialogProc(), not DefWindowProc(). In addition, even though Scheduler handles the WM_DESTROY window function, it passes control to DefDialogProc() as well. This ensures any additional cleanup for the dialog box can be handled by Windows. Included in this cleanup is the destroying of any custom window font specified by the dialog box template.

One last caution about using a dialog box as a main window: The default dialog procedure in Windows uses a few custom messages in the WM_USER range for its own use. If your dialog box uses user-defined messages, they should be assigned values of WM_USER + 10 or greater to avoid conflicting with Windows' handling of the dialog box. Although this caution applies to modal dialogs as well as dialogs used as main windows, user-defined messages are much more prevalent in main windows, so programmers should keep this in mind.

SCHEDULING EVENTS Scheduler keeps track of all the programs to run and when to run them by storing the data for each event in an array. When the program is started, it allocates enough memory for the maximum number of events, then reads its .INI file for any previously defined events. The structure used to store data for each event is shown in Figure 2.

The fFlags variable keeps flags defining the type of event—Once, Recurring, DoW, and DoM—and the start-up flags. An Error flag, which is set if an error occurs when a program is launched, is also kept here. The lData field keeps event-specific data. For the Once event, the data is the time and date of the future event. For a Recurring event, this field contains the interval between events. For days-of-the-week and days-of-the-month events, this field contains bit flags indicating which days are active. (The 32-bit size of the long variable is just large enough to hold flags for the 31 days of a month, with 1 bit to spare.)

The lTime field contains the time of day for the event. For Once, DoW, and DoM events, this is the time of day the program will be run. In the case of Recurring events, this field contains the time of day the program is first launched. The lNextTime field contains the time and date of the next time the program must be launched. This value is updated when the event is first defined by the user, after the event occurs, and when Scheduler is loaded. The final two fields, szCmd and szDir, contain the command line and the working directory.

Scheduler uses standard C library calls for all its time-related functions. The library call time() returns the number of seconds since midnight of December 31, 1899, in a long value. This is the basis for all the time-related values in Scheduler. The values in the lNextTime field of the array are the time, in seconds, from this reference time to the next scheduled event.

```
//
// Schedule entry format
//
typedef struct {
UINT    fFlags;
LONG    lData;
LONG    lTime;
LONG    lNextTime;
char    szCmd[MAXCMDLINELEN];
char    szDir[MAXCMDLINELEN];
} SCHENTRY;
```

Figure 2: **This data structure is used by Scheduler to store information about each event that has been scheduled.**

When the array contains at least one event, Scheduler starts a timer that sends a WM_TIMER message to the main window procedure every minute. Each time

the WM_TIMER message is received, the current time is determined using a call to time(). This value is compared with the lNextTime values in the array.

If any of the lNextTime values are less than or equal to the current time, Scheduler switches the current directory to the one listed in the szDir field and calls WinExec() to launch the program listed in the szCmd field. If the program launches successfully, the lNextTime value is updated, taking into account the type of event and the value in the lData field. If a launch error occurs, a message box is displayed indicating the error, and that event is disabled. When Scheduler is started, the lNextTime fields for each event are updated to take into account scheduled times that passed while the program was not running.

Scheduler provides a simple function, but it can come in very handy for the right task. And for programmers, Scheduler demonstrates how to use a dialog box as the main window. Enjoy Scheduler; it works, and it's easier to program than your VCR. □

DOUGLAS BOLING IS A CONTRIBUTING EDITOR OF *PC MAGAZINE*.

GUIDE TO OUR UTILITIES & HOW TO GET THEM

SCHEDULER

PURPOSE: Scheduler automatically runs DOS and Microsoft Windows programs according to a schedule that you set. Programs can be scheduled to run once, many times per day, on certain days of the week, or on certain days of the month.

SETUP: To install Scheduler, simply copy the program file, SCHED.EXE, to your hard disk. Then create an icon for it using the Program Manager, and place the icon in your Startup group. Scheduler will then be launched automatically each time you start Windows. When you first install Scheduler, you can launch it by double-clicking on its icon.

To schedule a program, click on the Add button. Fill in the details in the dialog box presented, and click on its Add button. Events can be edited and deleted by selecting them in the main window list box and clicking on the appropriate button.

REMARKS: There are three sections in the Schedule Program dialog box: Event Type, Event Details, and Program Details. The Event Type section is used to choose whether to schedule an event to run once, to recur at a set time interval, or to run on a certain day of the week or day of the month. Depending on the type of event you choose, you will be requested to fill in different fields in the Event Details section.

The Program Details section, along the bottom of the dialog box, lets you specify the command line for running the program, the working directory, and the state of the program when launched—minimized or not minimized. Generally, it is best to start scheduled programs as icons, running in the background. This prevents the automatically launched program from grabbing focus while you are in the midst of using another program.

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THE FIRST TIME If you've never used ZiffNet, you'll need to find the access number nearest you. Set your communications software to 7 data bits, even parity, no stop bits, and full duplex. Then dial 800-346-3247 with your modem. When the modem connects, press Enter. At the HOST NAME prompt, enter PHONES. Follow the menus and note the closest access number. Or dial 800-635-6225 (voice) for instructions.

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PC Solutions

TIPS AND TECHNIQUES TO INCREASE YOUR PRODUCTIVITY

■HARDWARE

Adding Storage to Your System

❓ I have a Microsoft Access database that links one field to a scanned image stored on my hard disk. The database has grown to more than 500 records, and I'd like to store the pictures somewhere else. Is there a way to produce a CD-ROM with my pictures on it in a format such as JPEG, so that I can link to the images on the CD rather than the hard disk? If so, how much would this cost? I need only one copy plus a second as backup. I looked into PhotoCD, but that would store only about 100 pictures, and I don't want to have to swap CDs all the time.

Rich Evans
Sterling, Virginia

▶**PC MAGAZINE:** You can certainly create your own CDs or have someone else do it for you, but I wonder if this is the most economical and efficient solution.

You can buy your own drive to create CDs for as little as $3,500 or so. And blank CDs cost $15 or less apiece. For more information, see "Roll Your Own CD" in our issue of May 17, 1994.

If you'd rather not buy your own recorder, you can certainly find a local service that will burn a CD for you. However, you'll have to provide them with the data. Backing it up on floppy disks would be a difficult task, and the service may not have a drive that can read your backup tapes. You would probably need to use a removable hard disk or similar device in order to be able to deliver the data.

Rather than go to all that trouble, why not consider simply adding another hard disk? JPEG compression can be very effective on images, and your 500 images may take less hard disk space than you think. I have a CD with 400 JPEG color photographs that take up less than 15MB. Even if your images do not compress as efficiently, you still should be able to fit 500 images in 25MB. And adding a second hard disk to your system is the least expensive solution.

Even if you wanted the images on a CD so that it would be easy to move them from one computer to another, a hard disk may still be the best solution. For about $350, you can get a 200MB hard disk that connects to your computer's parallel port, making it possible to move the disk from one machine to another. A 200MB hard disk will hold at least 4,000 images and offers a huge advantage over a CD-ROM: You can add or change images without having to burn a new CD.—*Alfred Poor*

Sideways CD

❓ Can you mount a CD-ROM drive on its side? I bought a computer in a desktop case, but I'd like to put it under my desk. It won't fit, though, unless I turn the case on its side. Will my CD-ROM drive still work if it's turned on its side?

Hank Hannau
New York, New York

▶**PC MAGAZINE:** The answer is a definite maybe. Some—but not all—CD-ROM drives can be mounted vertically. I checked with a technician at Toshiba about their drives. It turns out that you can mount both the caddy and caddy-less types of drives vertically—so that the disk is inserted into the drive on its edge, instead of the normal flat position. And it doesn't have to be perfectly vertical, either; within 10 degrees of vertical is still within the manufacturer's specifications.

The Toshiba caddy-less models have clips that grab and hold the CD in place, so these will work on their sides. There are other brands of caddy-less drives, however, that do not have similar clips; trying to get the CD to sit in the tray when one of these drives is sideways would be unlikely.

By the way, if you are considering some way-out case designs, the Toshiba technician reported that a horizontal mounting does not have to be precisely level, either. In fact, you can mount the drive so that it is tilted up to 45 degrees and still be within the manufacturer's specification. (Tilt it more than 45 degrees, however, and you'll have to keep going until the drive is within 10 degrees of vertical to get back in the specification range.)—*Alfred Poor*

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PC DIRECT

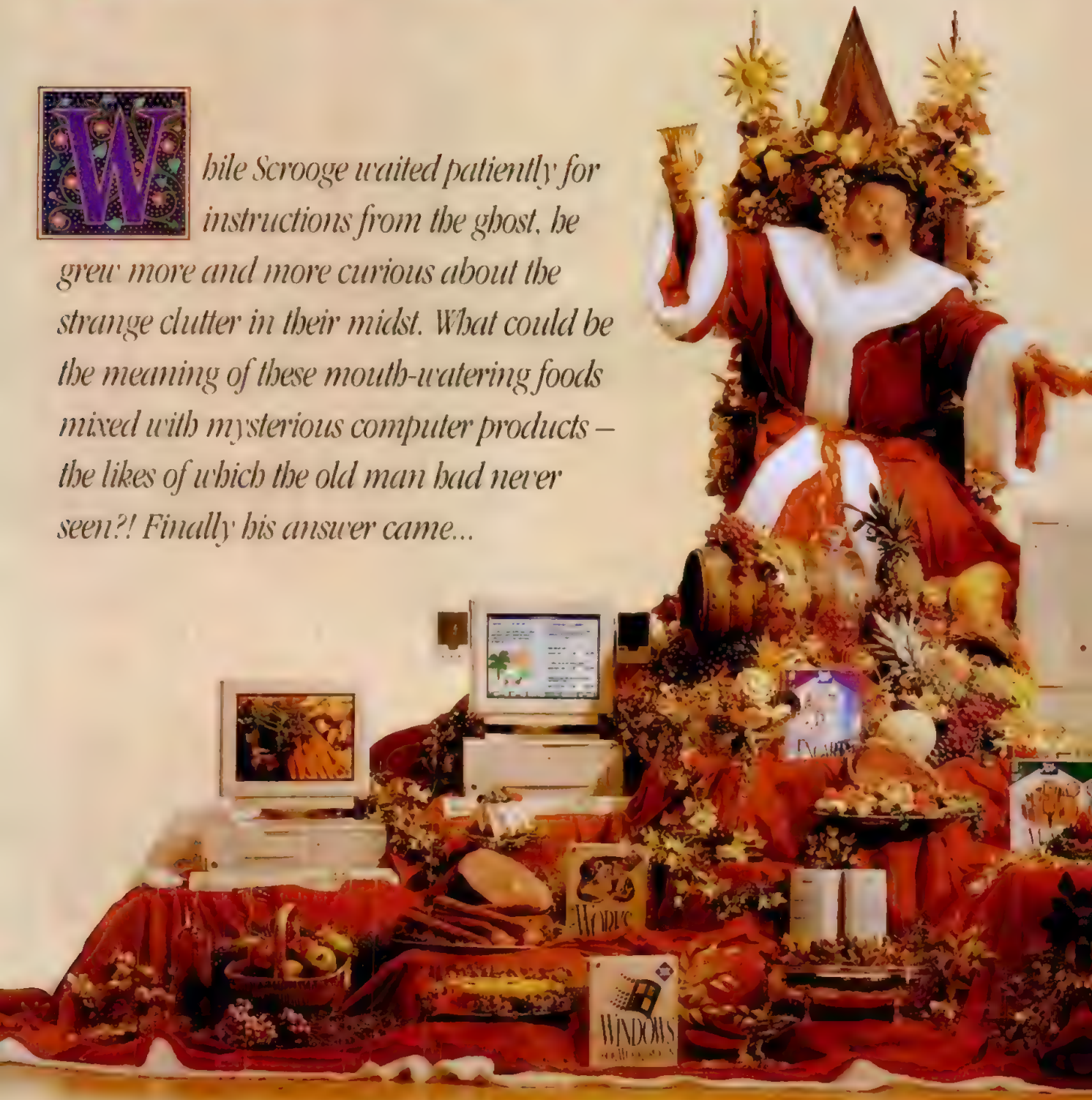
PC DIRECT starts here with exciting offers from top direct vendors.

See index, page 288.

Only MidWest Micro Could Alter Scrooge's Fate...

The Ghost of Computers Present—and Future

hile Scrooge waited patiently for instructions from the ghost, he grew more and more curious about the strange clutter in their midst. What could be the meaning of these mouth-watering foods mixed with mysterious computer products – the likes of which the old man had never seen?! Finally his answer came...



"I was sent to deliver the Present and *Future* of computer technology," the ghost bellowed. "These Intel-based Elite Systems which surround us have captured the extraordinary powers of PCI and Pentium™. It is now up to *you*, Ebenezer, to release them."

The spirit's thundering voice sent chills up Scrooge's brittle spine.

"Please, wise spirit, have mercy upon me. Tell me more about these 'Elites,' and what I, a mere mortal, must do to help your cause."

"Many of these fine Elite Systems contain a powerful Intel® Pentium Processor," explained the ghost, "capable of 60, 66 or 90 MHz speeds."

Scrooge never dreamed *anything* could move so quickly.

"While others," he continued, "rely on formidable 486 processors and advanced PCI Local Bus architecture for their impressive performance.

The spirit now turned to the system closest to him, a P5-90 Home PC – and with a single touch, brought its 15" monitor to life.

"Fear not, Scrooge," said the ghost. "Touch the key of your choice, and we shall begin."

Scrooge's trembling index finger came to rest on the symbol that was the dollar sign – in an instant the screen erupted into a multimedia frenzy. Without leaving the room, he saw himself walking about the streets of London – peering into the lives of those less fortunate. He could almost feel the cold air biting his bare feet...smell the aroma of a Christmas goose cooking. He even heard a choir of small children singing.

"Where do these angelic voices come from, spirit?" he asked.

"Altec Lansing Stereo Speakers," said the ghost.

The spirit then explained that it was the combination of a Pentium Processor, superscalar architecture and advanced PCI Local Bus technology that allowed this Elite to access peripherals with such haste.

When the adventure was over the ghost turned off the system and looked down earnestly upon Scrooge.

"These people you have just witnessed, hunger desperately for power. Without an Intel-based Elite System in their lives, I shudder to think what may become of them. You must tell them of Pentium and PCI – of MidWest Micro's affordable PCI, Home PC and Pentium Processor Based Systems!"

"You have my word," promised Scrooge.

"And you, Scrooge, do you hunger as well?"

"Yes, spirit. I too could benefit from the power of an Elite."

"No," said the ghost, "I *mean* are you *hungry*? I fear I cannot eat all this food without help."

And since Scrooge did not expect another spirit until the bells tolled one, he seated himself with the ghost among the awe-inspiring Elites – and thus began to feast.

MIDWEST MICRO

IT'S IN OUR NATURE

Systems

1-800-682-7256

Peripherals

1-800-445-2794

intel inside

WINDOWS FOR WORKGROUPS

AD#G12

90 MHz Pentium™ Loud and Strong Enough to Break the Chains

Trembling at the sight of Jacob Marley's ghost, Ebenezer Scrooge still managed to utter one more "Bah Humbug!" Perhaps it was just a bad chestnut or bite of plum pudding causing him to hallucinate. As he was pondering this, the vision spoke...

"Poor old Ebenezer," his dead partner moaned. "This is neither a dream nor indigestion. I have come to warn you before it's too late – you see, these chains I bear are those I forged in life. And unless you change your way of computing, this will be your fate as well. Like you, I believed a faster, more versatile machine was the key to prosperity. Unfortunately, this obsession with power kept me chained to my office – day in and day out. In my search for the perfect computer, I encountered only a few desktop systems swift enough to suit me – but alas, they were dreadfully heavy. And the portables? Why, I fear my horse-drawn carriage could run faster."

Scrooge nodded in agreement, for he recognized Marley's plight.

"Tell me, Jacob, whatever can I do?" he asked.

"Hold onto your nightcap, Ebenezer – for you will scarcely believe what you are about to witness."

Scrooge looked closely at the object floating above Marley's wrinkled hands.

"Why, it's just another notebook," he said.

"No," shrieked Marley, "this is the Elite SoundBook Plus based on Intel's Pentium™ Processor. It's like no other notebook you've ever seen...or heard!"

"And it dares to challenge my full-size computer?" asked Scrooge in amazement.

"Did my words escape you, old man?! The Elite SoundBook Plus has captured the power of *Pentium*! Couple that with its remarkable PCI Local Bus architecture, high-speed synchronous cache and 16-bit stereo soun – and this 90 MHz notebook more than '*challenges*' your cumbersome computer... it clearly outperforms it!"

"But a portable Pentium?!" gasped Scrooge. "A talking 90 MHz notebook?! It's pure humbug I tell you."

Yet Ebenezer prayed this spirit spoke the truth. For an invention such as this would surely double his productivity – and thus free him from his dark and gloomy office. Marley then summoned the Elite 486 SoundBook with business audio features and an assortment of delightful screens, rapid processors and generous hard drives to choose from.

"Oh thank you, Jacob," cried Scrooge. "Thank you for delivering these remarkable notebooks from heaven's gates to my humble chambers."

"Heaven, indeed!" laughed the ghost. "Elite SoundBooks are found right here on earth – but only at MidWest Micro."

"Then what about the price?" asked Scrooge. "Notebooks such as these surely cost a full year's wages!"

"Wrong again," said Marley. "MidWest Micro knows you don't want to *pay* extra pounds any more than you wish to *carry* them. That's why they offer these lightweight Elites at prices even *your* employees can afford."

And without another word, the late Jacob Marley was gone...leaving only a puff of smoke and MidWest Micro's toll-free number behind.

intel inside pentium

MIDWEST MICRO

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Systems

1-800-682-7256

Peripherals

1-800-445-2794

AD#G12

ELITE HOME PCs

486SX-33 $1499
#008650

- Intel486™ SX-33 Processor
- 4 Mb RAM, 128 Kb Cache
- 428 Mb IDE Hard Drive
- 32-Bit Local Bus Graphics with 1 Mb
- 32-Bit Local Bus IDE
- Double Speed CD-ROM Drive
- Microsoft® Family Bundle – Encarta™, Works, Money, Scenes, Dangerous Creatures & Golf
- 16-Bit Stereo Sound Card
- Digital Quality Speakers
- 14.4 S/R Fax Modem
- 3.5" Disk Drive
- 14" SVGA .28 N/I Color Monitor with Hitachi CRT
- Slimline Case
- 4 ISA & 1 VESA/ISA Slots
- 101-Key Enhanced Keyboard
- Microsoft Mouse
- MS-DOS® 6.22 and WFW 3.11
- EPA Energy Star Compliant
- The Real 3 Year Warranty

486DX2-66 $1999
#008651

- Intel DX2™ 66 Processor
- 8 Mb RAM, 128 Kb Cache
- 730 Mb IDE Hard Drive
- 32-Bit Local Bus Graphics with 1 Mb
- 32-Bit Local Bus IDE
- Double Speed CD-ROM Drive
- Microsoft Family Bundle – Encarta, Works, Money, Scenes, Dangerous Creatures & Golf
- 16-Bit Stereo Sound Card
- Altec Lansing Stereo Speakers
- 14.4 S/R Fax Modem
- 3.5" Disk Drive
- 15" SVGA .28 Digital Color Monitor with Hitachi CRT
- Slimline Case
- 4 ISA & 1 VESA/ISA Slots
- 101-Key Enhanced Keyboard
- Microsoft Mouse
- MS-DOS 6.22 and WFW 3.11
- EPA Energy Star Compliant
- The Real 3 Year Warranty

P5-60 $2299
#008652

- Intel® 60 MHz Pentium™ Processor
- 8 Mb RAM, 256 Kb Cache
- 730 Mb IDE Hard Drive
- PCI Fast IDE Interface
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- Microsoft Family Bundle – Encarta, Works, Money, Scenes, Dangerous Creatures & Golf
- 16-Bit Stereo Sound Card
- Altec Lansing Stereo Speakers
- 14.4 S/R Fax Modem
- 3.5" Disk Drive
- 15" SVGA .28 Digital Color Monitor with Hitachi CRT
- 8-Bay Mini-Tower Case
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- Signature 101-Key Enhanced Keyboard
- Microsoft Mouse
- MS-DOS 6.22 and WFW 3.11
- The Real 3 Year Warranty

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- Intel 90 MHz Pentium Processor
- 8 Mb RAM, 256 Kb Cache
- 730 Mb IDE Hard Drive
- PCI Fast IDE Interface
- ATI MACH 64 PCI Accelerator with 2 Mb
- Double Speed CD-ROM Drive
- Microsoft Family Bundle – Encarta, Works, Money, Scenes, Dangerous Creatures & Golf
- 16-Bit Wavetable Sound Card
- Altec Lansing Stereo Speakers
- 14.4 S/R Fax Modem
- 3.5" Disk Drive
- 15" SVGA .28 Digital Color Monitor with Hitachi CRT
- 8-Bay Mini-Tower Case
- 4 ISA, 2 PCI & 1PCI/ISA Slots
- Signature 101-Key Enhanced Keyboard
- Microsoft Mouse
- MS-DOS 6.22 and WFW 3.11
- The Real 3 Year Warranty

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•All Systems with a CD-ROM include TestDrive CD Software and Microsoft Home CD Sampler•

Elite PCI Systems

SX-33 PCI $1199
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- Intel486 SX-33 Processor
- 4 Mb RAM, 128 Kb Cache
- 428 Mb IDE Hard Drive
- PCI Fast IDE Interface
- PCI Local Bus Graphics with 1 Mb
- 9624 S/R Fax Modem
- 3.5" Disk Drive
- 14" SVGA .28 N/I Color Monitor with Hitachi CRT
- 8-Bay Mini-Tower Case
- 3 ISA, 2 PCI & 1 PCI/ISA Slots
- Super I/O using 16550 UART & ECP/EPP
- 101-Key Enhanced Keyboard
- High-Resolution Mouse
- MS-DOS 6.22 and WFW™ 3.11
- MS® Works for Windows™ 3.0
- EPA Energy Star Compliant
- The Real 3 Year Warranty

DX2-50 PCI $1299
#008656

DX2-66 PCI $1399
#008657

DX2-50 PCI $1499
#008658

- IntelDX2 50 Processor
- 4 Mb RAM, 128 Kb Cache
- 545 Mb IDE Hard Drive
- PCI Fast IDE Interface
- PCI Local Bus Graphics with 1 Mb
- Double Speed CD-ROM Drive
- 9624 S/R Fax Modem
- 3.5" Disk Drive
- 15" SVGA .28 Digital Color Monitor with Hitachi CRT
- 8-Bay Mini-Tower Case
- 3 ISA, 2 PCI & 1 PCI/ISA Slots
- Super I/O using 16550 UART & ECP/EPP
- 101-Key Enhanced Keyboard
- High-Resolution Mouse
- MS-DOS 6.22 and WFW 3.11
- MS Word 6.0, Bookshelf™ '94, Encarta, & Works Multimedia Edition 3.0
- EPA Energy Star Compliant
- The Real 3 Year Warranty

DX2-66 PCI $1599
#008659

DX2-66 PCI $1799
#008660

- IntelDX2 66 Processor
- 8 Mb RAM, 128 Kb Cache
- 545 Mb IDE Hard Drive
- PCI Fast IDE Interface
- PCI Local Bus Graphics with 1 Mb
- Double Speed CD-ROM Drive
- 14.4 S/R Fax Modem
- 3.5" Disk Drive
- 15" SVGA .28 Digital Color Monitor with Hitachi CRT
- 8-Bay Mini-Tower Case
- 3 ISA, 2 PCI & 1 PCI/ISA Slots
- Super I/O using 16550 UART & ECP/EPP
- Signature 101-Key Enhanced Keyboard
- Microsoft Mouse
- MS-DOS 6.22 and WFW 3.11
- MS Word 6.0, Bookshelf '94, Encarta, & Works Multimedia Edition 3.0
- EPA Energy Star Compliant
- The Real 3 Year Warranty

DX2-66 PCI $1999
#008661

- IntelDX2 66 Processor
- 8 Mb RAM, 128 Kb Cache
- 730 Mb IDE Hard Drive
- PCI Fast IDE Interface
- ATI MACH 64 PCI Accelerator with 2 Mb
- Double Speed CD-ROM Drive
- 14.4 S/R Fax Modem
- 3.5" Disk Drive
- 15" SVGA .28 Digital Color Monitor with Hitachi CRT
- 8-Bay Mini-Tower Case
- 3 ISA, 2 PCI & 1 PCI/ISA Slots
- Super I/O using 16550 UART & ECP/EPP
- Signature 101-Key Enhanced Keyboard
- Microsoft Mouse
- MS-DOS 6.22 and WFW 3.11
- MS Word 6.0, Bookshelf '94, Encarta, & Works Multimedia Edition 3.0
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- The Real 3 Year Warranty

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ATI Perfecting the PC

Elite Pentium™ Processor Based Systems

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- 428 Mb IDE Hard Drive
- PCI Fast IDE Interface
- PCI Local Bus Graphics with 1 Mb
- Double Speed CD-ROM Drive
- 3.5 Disk Drive
- 15" SVGA .28 Digital Color Monitor with Hitachi CRT
- 8-Bay Mini-Tower Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- Super I/O using 16550 UART & ECP/EPP
- Signature 101-Key Enhanced Keyboard
- Microsoft Mouse
- MS-DOS 6.22 and WFW 3.11
- MS Word 6.0, Bookshelf '94, Encarta, & Works Multimedia Edition 3.0
- The Real 3 Year Warranty

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#008663

- Intel 66 MHz Pentium Processor
- 8 Mb RAM, 256 Kb Cache
- 545 Mb IDE Hard Drive
- PCI Fast IDE Interface
- ATI MACH 64 PCI Accelerator with 2 Mb
- Double Speed CD-ROM Drive
- 3.5" Disk Drive
- 15" SVGA .28 Digital Color Monitor with Hitachi CRT
- 8-Bay Mini-Tower Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- Super I/O using 16550 UART & ECP/EPP
- Signature 101-Key Enhanced Keyboard
- Microsoft Mouse
- MS-DOS 6.22 and WFW 3.11
- MS Word 6.0, Bookshelf '94, Encarta, & Works Multimedia Edition 3.0
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P5-90 $2499
#008664

- Intel 90 MHz Pentium Processor
- 8 Mb RAM, 256 Kb Cache
- 545 Mb IDE Hard Drive
- PCI Fast IDE Interface
- ATI MACH 64 PCI Accelerator with 2 Mb
- Double Speed CD-ROM Drive
- 14.4 S/R Fax Modem
- 3.5" Disk Drive
- 15" SVGA .28 Digital Color Monitor with Hitachi CRT
- 8-Bay Mini-Tower Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- Super I/O using 16550 UART & ECP/EPP
- Signature 101-Key Enhanced Keyboard
- Microsoft Mouse
- MS-DOS 6.22 and WFW 3.11
- MS Office Professional
- The Real 3 Year Warranty

P5-90 $2999
#008665

- Intel 90 MHz Pentium Processor
- 16 Mb RAM, 256 Kb Cache
- 730 Mb IDE Hard Drive
- PCI Fast IDE Interface
- ATI MACH 64 PCI Accelerator with 2 Mb
- Double Speed CD-ROM Drive
- 28.8 S/R Fax Modem
- 3.5" Disk Drive
- 15" SVGA .28 Digital Color Monitor with Hitachi CRT
- 8-Bay Middle-Tower Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- Super I/O using 16550 UART & ECP/EPP
- Signature 101-Key Enhanced Keyboard
- Microsoft Mouse
- MS-DOS 6.22 and WFW 3.11
- MS Office Professional
- The Real 3 Year Warranty

P5-90 $3499
#008666

- Intel 90 MHz Pentium Processor
- 16 Mb RAM, 256 Kb Cache
- 1 Gb IDE Hard Drive
- PCI Fast IDE Interface
- ATI MACH 64 PCI Accelerator with 2 Mb VRAM
- Double Speed CD-ROM Drive
- 14.4 S/R Fax Modem
- 3.5" Disk Drive
- 17" .26 Digital Color Monitor
- 10-Bay Full-Tower Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- Super I/O using 16550 UART & ECP/EPP
- Signature 101-Key Enhanced Keyboard
- Microsoft Mouse
- MS-DOS 6.22 and WFW 3.11
- MS Office Professional
- The Real 3 Year Warranty

P5-90 $3999
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With 2 Gb HDD and Without 14.4 S/R Fax Modem

intel inside pentium

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14" to 15"	$69
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15" to 17"	$259
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If you don't see a system configuration which meets your needs, we'll be glad to customize a system for you. Choose your own case design, amount of RAM, hard drive size and other add-ons such as modems and multimedia kits.

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Peripherals
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AD#G12

Elite SoundBook Plus Based On Intel's Pentium™ Processor

- Intel® Pentium™ 90 MHz Processor
- 64-Bit, 256K Synchronous Burst External Cache
- 64-Bit, 8 Mb RAM (expands to 40 Mb)
- 10.3" Dual Scan or 10.4" Active-Matrix VGA Display
- PCI Local Bus Video with 1 Mb Video DRAM
- PCI Local Bus HDD Controller
- 16-Bit Stereo Audio (Sound Blaster & Windows™ Sound System Compatible)
- Built-in Stereo Speakers & Microphone
- External Jacks for Line In & Line Out
- 3.5" Built-in Disk Drive
- User Replaceable Hard Drive
- Two Type II/One Type III PCMCIA Slot
- Built-in Track Point Style Pointing Device
- NiMH Battery & AC Adapter
- Advanced Power Management
- Bi-directional EPP/ECP Parallel Port
- High Speed 16550 UART Serial Port
- Infra Red Wireless "IR" Interface
- External VGA & Keyboard/Mouse Port
- MS-DOS® 6.22 & WFW® 3.11
- Microsoft® Works for Windows 3.0
- Lotus Organizer™
- Weight: 6.8 lbs.
- Carrying Case
- One Year Manufacturer's Warranty

Dual-Scan Color SoundBook Plus

P5-90 with 340 Mb HDD
#008029 **$3599**

P5-90 with 520 Mb HDD
#008025 **$3799**

P5-90 with 720 Mb HDD
#008026 **$3999**

Active-Matrix Color SoundBook Plus

P5-90 with 520 Mb HDD & 16 Mb of RAM
#008027 **$5499**

P5-90 with 720 Mb HDD & 24 Mb of RAM
#008028 **$5999**

Elite SoundBook

- Intel486™, IntelDX2™, or IntelDX4™ Processor
- 4 Mb RAM (expands to 20 Mb)
- 9.5" Mono, 10.3" Dual-Scan or 9.5" Active-Matrix VGA Display
- Local Bus Video with 1 Mb Video DRAM
- Business Audio Features Including: Built-in Microphone & Speaker External Jacks for Line In & Line Out
- 3.5" Built-in Disk Drive
- User Replaceable Hard Drive
- Two Type II/One Type III PCMCIA Slot
- Built-in Trackball
- NiMH Battery & AC Adapter
- Advanced Power Management
- One Parallel & One Serial Port
- External VGA & Keyboard Port
- MS-DOS 6.22 & WFW 3.11
- Microsoft Works for Windows 3.0
- Lotus Organizer
- Weight: Mono – 6.2 lbs. Color – 6.7 lbs.
- Carrying Case
- One Year Manufacturer's Warranty

Dual-Scan Color SoundBook

486SX-33 with 260 Mb HDD
#008065 **$1999**

DX2-50 with 340 Mb HDD
#008066 **$2099**

DX2-66 with 520 Mb HDD & 8 Mb of RAM
#008067 **$2499**

DX4-75 with 520 Mb HDD & 8 Mb of RAM
#008068 **$2699**

DX4-100 with 520 Mb HDD & 12 Mb of RAM
#008070 **$2999**

DX4-100 with 700 Mb HDD, 12 Mb of RAM & PCMCIA 14.4 S/R Fax Modem
#008069 **$3199**

DX4-100 with 700 Mb HDD, 20 Mb of RAM & PCMCIA 14.4 S/R Fax Modem
#008071 **$3699**

Active-Matrix Color SoundBook

DX2-66 with 340 Mb HDD
#008077 **$2999**

DX4-75 with 520 Mb HDD & 8 Mb of RAM
#008078 **$3499**

DX4-100 with 520 Mb HDD & 12 Mb of RAM
#008079 **$3799**

DX4-100 with 700 Mb HDD, 12 Mb of RAM & PCMCIA 14.4 S/R Fax Modem
#008080 **$3999**

DX4-100 with 700 Mb HDD, 20 Mb of RAM & PCMCIA 14.4 S/R Fax Modem
#008081 **$4499**

Monochrome SoundBook

486SX-33 with 260 Mb HDD
#008072 **$1399**

DX2-50 with 340 Mb HDD
#008073 **$1499**

DX2-66 with 520 Mb HDD
#008074 **$1699**

DX4-75 with 520 Mb HDD & 8 Mb of RAM
#008075 **$2099**

DX4-100 with 700 Mb HDD & 8 Mb of RAM
#008076 **$2299**

Options

4 Mb RAM Card	#005976	$219
8 Mb RAM Card	#005977	$469
16 Mb RAM Card	#005978	CALL
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Stump the Panel

❓ I have a notebook computer with an external VGA port, and an LCD overhead-projection panel that works with either CGA or EGA signals to create a monochrome image. Is it possible to use this panel with the notebook? Would I need some kind of an adapter?

Richard A. Bassler
Fairfax Station, Virginia

▶**PC MAGAZINE:** You can't easily attach a VGA output to a CGA input, and one or more adapters will surely be required. The parts are certainly available, but I'm not sure it's worth the cost and effort.

The problem stems from the differences between CGA and VGA signals. Perhaps most critical is the fact that a CGA signal is digital while a VGA signal is analog. The CGA signals are simply either high or low (on or off), controlling the red, green, and blue electron guns of the monitor, with a second intensity signal for each gun. With VGA, on the other hand, the relative strength of the signal on each of the red, green, and blue channels determines the color; given a large enough range of voltages for each signal, you can create a nearly infinite range of colors on the screen.

So the first problem is that you need to convert the VGA analog signal into a CGA digital signal. There are devices on the market that can perform this type of conversion, but typically they cost hundreds of dollars. And there are further problems. The resolutions of the two images are different: CGA is limited to 320-by-200 (16-color) or 640-by-200 (2-color) mode; VGA produces those plus many others including the 640-by-350 and 640-by-400 graphics modes that are frequently used. These different modes require different horizontal and vertical scan frequencies than are supported by CGA, so you need to convert the faster VGA signals into something the slower CGA device can display. This requires a scan converter, which can be an expensive item.

If your LCD panel has a composite video input in addition to the standard 9-pin CGA connector, you may be able to use an inexpensive solution to the problem. There are a number of converters on the market that allow you to send a VGA signal to a television; these use composite video as the output signal for the television. Many CGA devices include a composite video input, and if your panel has one, this may be an easy solution.

No matter what route you take, however, keep in mind that your panel will not be able to display all the detail from the VGA image, especially if the panel has a 320-by-200 resolution. Your panel may be suitable for images that have large objects (such as text slides from a presentation program), but if you plan to display VGA text screens, you may be disappointed in the legibility of the result.—*Alfred Poor*

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■ **OPERATING ENVIRONMENTS**

Understanding Free System Resources

❓ I have a 386-SX with 8MB of RAM and a 200MB IDE hard disk. Whenever I start Microsoft Windows, I always have 85 percent of the system resources available. Of course, as soon as I run one or more programs, I have fewer system resources. But when I exit out of all the programs I'm running and return to the Norton Desktop and then check the system re-

sources, I invariably have less than 80 percent. Also, it seems that the longer I use or stay in a program, the fewer resources I have available upon exit, sometimes as low as 65 percent.

If the only program open is the desktop, where did all the system resources go? The only way I've found to get them back is to exit Windows and start all over.

Tim Bayless
Bloomington, Indiana

❓ Windows gives you access (via the About Program Manager Box on the Help menu) to a value indicating the total percentage of free system resources. But when you're having resource problems, this value does not help you locate the source of the problem. Microsoft also distributes a program called SysMeter with its Windows Resource Kit. This program graphically displays the percentages of free user heap (U), GDI heap (G), and global memory (M) individually.

After starting Windows on a Compaq 486 with 8MB of memory, the percentages given for U, G, and M are typically 86, 75, and 88, respectively. When I then start applications, obviously these values will decrease. That's to be expected. What I don't understand is why, even after I exit the applications, G never goes back to its original value, while U and M do return to their start-up values. It seems that the applications always leave something behind. Is there any way to exit completely from Windows applications?

Paul Scherrer
Zurich, Switzerland

▶**PC MAGAZINE:** The vast majority of the internal functions that make Windows work reside in three libraries called KERNEL, GDI, and USER. In addition, certain essential data elements belonging to individual Windows programs are stored in the data space of GDI and USER. There's a 64K size limit on these local *heap* data spaces, and that's where the concept of free system resources (FSRs) comes in.

Under Windows 3.0, a single heap in the GDI library held graphical elements like pens, brushes, and palettes, and a single heap in the USER library held window class names, resources, and menu data. Windows 3.1 has improved the situation somewhat by allocating a separate menu heap in the USER library. Still, if any one of these heaps fills up, Windows comes to a screeching halt. The FSR percentage is calculated by checking the percentage free in each heap and reporting the smallest. (The amount of system memory free has nothing to do with FSRs; in fact, you can run out of FSRs and still have many megabytes of system memory free.)

As for the gradual attrition in system resources as Windows runs, for the most part it's caused by programs that don't properly clean up after themselves. A one-time drop in resources after you load and terminate a program isn't necessarily a sign of lost resources. However, a drop each time you run a program indicates a resource leak. The problem almost always involves GDI resources, because Windows leaves cleanup of these resources to the programmer. USER resources are automatically returned when the program

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ends, with one exception. If a program has multiple menus, the programmer is responsible for destroying all but the active menu.

We can only hope the arrival of Windows 95 (previously code-named Chicago) will eliminate the resource problem. Meanwhile, you'll just have to restart Windows occasionally to regain lost resources.—*Neil J. Rubenking*

WORD PROCESSING

Getting the Desired Page Number into a Footer

❓ I use Microsoft Word for Windows 6.0, and I often need to produce documents with a header that includes the page number and a footer of the form "Continued on page *n*," where *n* is the number on the following page. Setting up the header for automatic numbering is straightforward enough, but I've found no way to enter the footer except by typing it in. Can I set the footer to show the current page number plus 1 automatically?

Corrie Maries
Comox, British Columbia

▶**PC MAGAZINE:** Adding the page number of the next page to your footer is easy enough in WinWord, but it's also easy to miss if you're not used to working with fields. The trick is to combine the Page field, which gives the current page number, with the Formula field, which lets you calculate a result. The combined field (as it looks when you view field codes) is simply:

```
{=(page)+1}
```

This calculation adds 1 to the result of the Page field, which gives the number for the following page.

You can use menu commands or toolbar buttons to insert any WinWord field into a document, but it's easiest to create a compound field like this by typing it in directly. Be aware that although the curly braces in the example *look* like bolded versions of those you can type from the keyboard, *they aren't the same characters.* To enter these field characters, press Ctrl-F9. WinWord will insert both the opening and closing braces at once, leaving the cursor between them. To insert a second set of field characters inside the first pair, press Ctrl-F9 again. Now type the field text inside the appropriate braces.

If you use this footer format regularly, you might want to convert it into an autotext entry. Start by creating the entire phrase for the footer, such as:

```
Continued on page {=(page)+1}
```

Now select the entire phrase (including the field), choose Edit Autotext, enter an appropriate abbreviation (such as Contin), choose Add, and then choose File Save All to save the new entry to disk. Once it has been created, you can enter the entire footer at any time simply by typing the abbreviation and pressing F3.—*M. David Stone*

SPREADSHEETS

1-2-3 Databases and Days of the Week

❓ I use Lotus 1-2-3 to keep track of sick days for 36 employees. I put the employees' initials in column headings and the dates in row headings. Whenever an employee takes part or all of a sick day, I record the number of days taken in the appropriate cell. The problem is that I need a way to find the total for each day of the week (the number of Mondays, Tuesdays, Wednesdays, and so on) taken by each employee. I also need yearly totals by weekday for all employees. How do I do this in 1-2-3?

Nandita Nag
Scarborough, Ontario

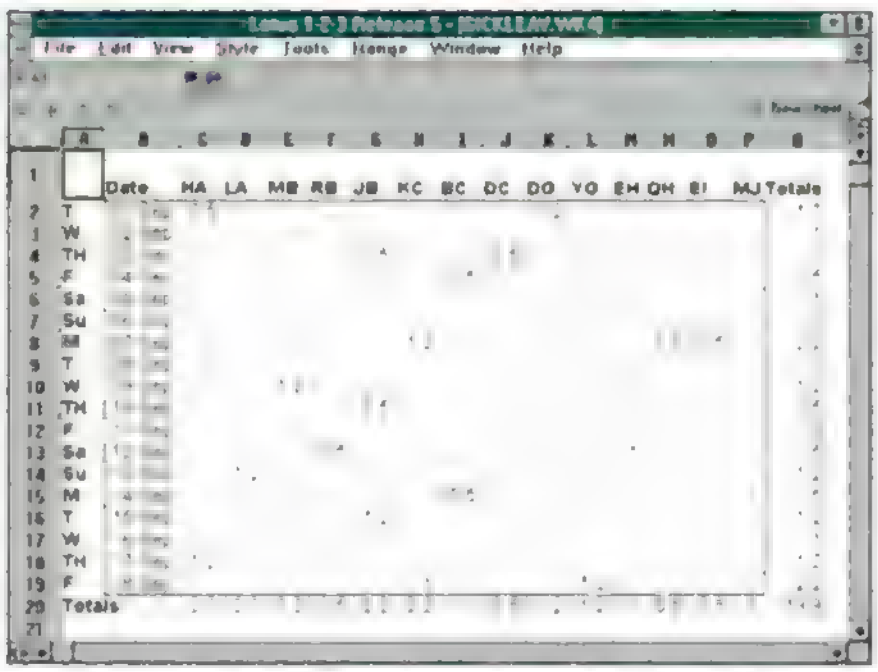

Figure 1: **This very sparse Lotus 1-2-3 worksheet keeps track of employees' sick-leave days.**

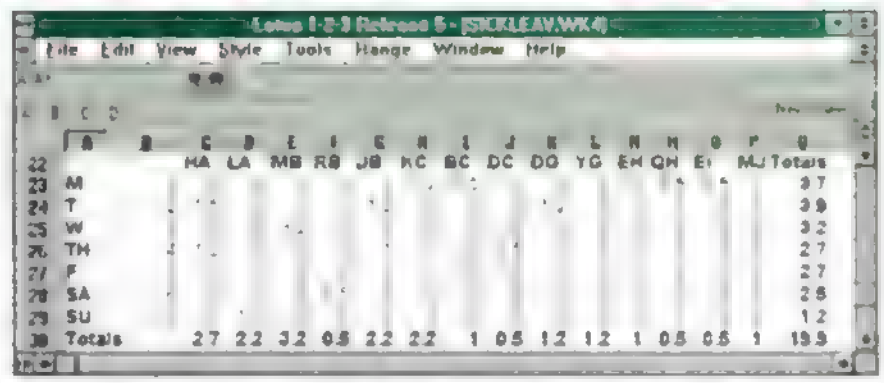

Figure 2: **This Lotus 1-2-3 table uses @DSUM and @WEEKDAY to return the number of sick days taken by each employee on each day of the week.**

▶**PC MAGAZINE:** I have reproduced a segment of Ms. Nag's worksheet in Figure 1. The actual worksheet is much deeper and broader than the figure; it includes a column for each of 36 employees and a row for each day of the year, including Saturdays and Sundays. Note that the grid is extremely sparse; most of the cell entries are blank.

The way to get totals by weekday from this organizational scheme is to use @DSUM, together with the @WEEKDAY. @WEEKDAY(date) returns a number representing the day of the week on which the date falls. A return value of 0 means Sunday, 1 means Monday, and so on. @DSUM(*input,field,criterion*) returns the sum of all the values in column *field* of range *input* that meet the filter specified by *criterion*. In 1-2-3, Releases 3.*x* and later, the field argument can be either a number—with 0 meaning the first column, 1 the second, and so on—or a piece of text matching the field label for a column. I prefer the latter approach, so I've used "HA" as my field argument. But rather than hard-coding "HA", I've simply made a reference to the cell containing "HA". I made this reference row-absolute so the formula could be replicated downward and column-relative so that when replicated to the right it would reference the adjacent cells—D1, E1, and so on.

Figure 2 shows how you might build a table, using @DSUM and @WEEKDAY, that would return the number of sick days taken by each employee on each day of the week. The formula at C23

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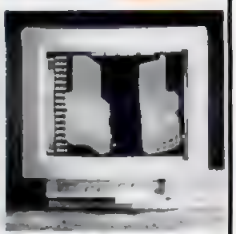

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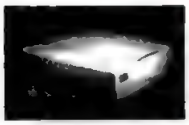

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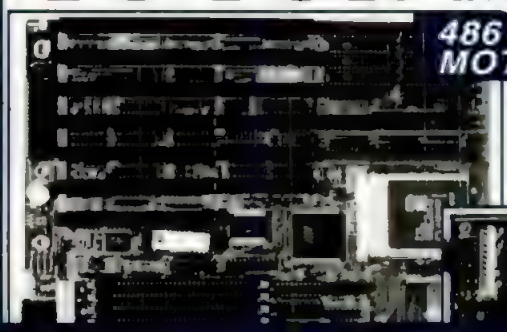

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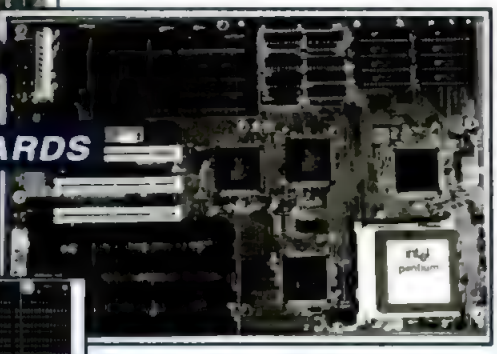

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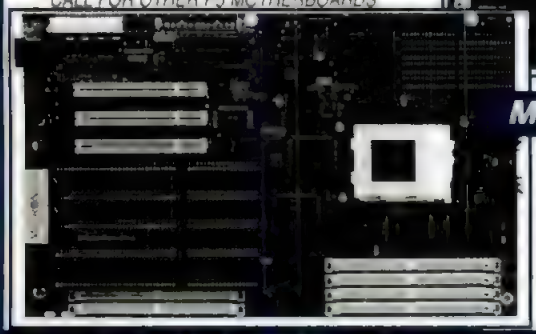

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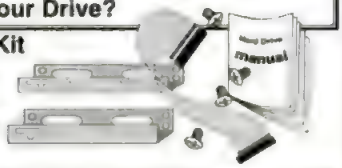

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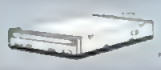

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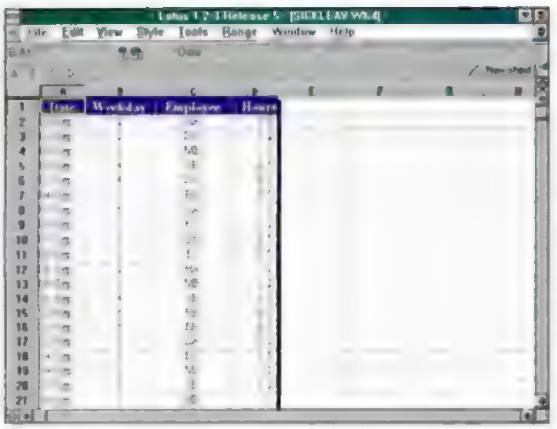

Figure 3: **This on-sheet database is a more economical way to keep track of sick-leave days taken by employees than the method shown in Figures A and B.**

```
@SUM($DDATABASE,C$1,@WEEKDAY(DATE
=$B23)
```

is designed to be replicated throughout the table. You would enter the formula once and then copy it and paste it into C23..P29. (Or, in Lotus 1-2-3 for Windows, use the Fill by Example command to replicate C23 into C23..P29.) Meanwhile, ordinary @SUM formulas in row 30 and column Q give you the aggregate values by employee and weekday.

In order to make all this work, I've named the input range (B1..P19; see Figure 1) Database, and I've entered the numbers 0 through 6 in B23..B29. These numbers are the seven possible return values of the @WEEKDAY function. Note that the @DSUM formula quoted above requires Lotus 1-2-3 for Windows, Release 4.*x* or 5.*x*, or Lotus 1-2-3 for DOS, Release 3.*x* or Release 4.*x*. Earlier versions of 1-2-3 don't allow you to incorporate a criterion expression directly into the @DSUM function; instead, the *criterion* argument must be a reference to a range on the worksheet that specifies your filter criterion. (For more about using @DSUM in Release 2.*x*, see the Spreadsheets column "Ignore Invalid Cells with Database Functions" in our issue of October 25, 1994.)

The scheme using @DSUM and @WEEKDAY, shown in Figure 2, works just fine, but if Ms. Nag is using 1-2-3 for Windows, I think she would be better served by an altogether different way of tackling the problem. Rather than tallying sick-leave days in a gigantic, sparse matrix, why not create an on-sheet database of the kind shown in Figure 3?

From this table, in which each sick-leave occurrence gets one row, you can easily generate the crosstab report shown in Figure 4. Just select the database, choose Tools | Database | Crosstab, and specify Weekday as your "Row headings" field, Employee as your "Column headings" field, and Hours as the field to be summarized. (The Weekday field is made up of numbers generated by @WEEKDAY formulas.) 1-2-3 does all the grunt work and gives you an easy-to-read table on a fresh sheet. Add a row of totals at the bottom and a column of totals at the right, convert the day numbers to day names, and you're done.—*Craig Stinson*

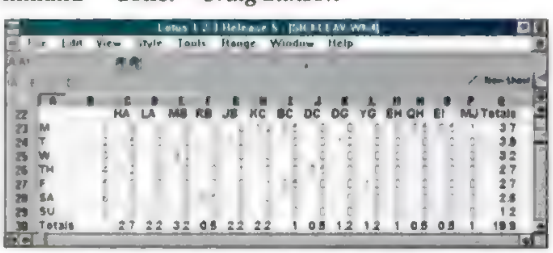

Figure 4: **This crosstab report was easily generated from the data in Figure 3.**

■DATABASES

End of Job in FoxPro for Windows

❓ I have a FoxPro for MS-DOS routine that prints the current record to the printer. It uses SET DEVICE TO PRINTER to direct output to the printer and a series of @ SAY commands to position output on the printed page.

After moving this routine to FoxPro for Windows, everything worked fine—except that I couldn't get the printer to start printing until I quit my application. How can I get the printer to start printing immediately?

Edward Sansone
Smithtown, New York

▶PC MAGAZINE: FoxPro for Windows is sending your printed output to the Windows print spooler. To signal an "end of print job" to Windows, place a SET PRINTER TO command, with no argument, at the end of your routine. The SET PRINTER TO command redirects printer output to a file or to a certain printer port. When issued without an argument, it resets printer output to the PRN device and has the added effect in Windows of signaling "end-of-job" so that the Windows print spooler starts printing.
—*Sal Ricciardi*

FoxPro CREATE TABLE Commands

TIP Figure 5 shows a simple FoxPro program that will save you some typing if you need to build a long CREATE TABLE statement for an existing table that has a lot of fields. It generates the statement using the currently open database and places the text for the command into the clipboard for insertion into your program. My program doesn't use any temporary files and illustrates use of the AFIELDS() array function and the _CLIPTEXT system variable. It formats the command a little, but any desired continuation semicolons are left for the programmer to handle according to his own style.

Bob Keys
Lake Los Angeles, California

▶PC MAGAZINE: To use Mr. Keys's program, open a table with the USE command and then issue the command

```
DO GENCRT
```

Seconds after the program finishes, the _CLIPTEXT system variable contains your CREATE TABLE command.

The _CLIPTEXT system memory variable holds the contents of FoxPro's clipboard. To modify the clipboard programmatically, you can alter _CLIPTEXT, as Mr. Keys does in his program.

The _CLIPTEXT variable can be modified just like any other memory variable. Mr. Keys begins by setting _CLIPTEXT to a text string that contains "CREATE TABLE" plus the name of the table and an opening parenthesis.

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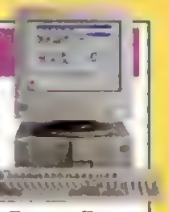

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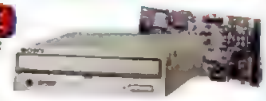

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CIRCLE 210 ON READER SERVICE CARD

```
*********************************************************************
* GENCRT.PRG                                          FoxPro for Windows
* Program that constructs the text for a CREATE TABLE command
* based upon the currently open table or the table whose name
* is passed to this program as a parameter, placing the command into
* the clipboard for insertion into a program.
*
* Usage: DO GENCRT or DO GENCRT WITH "TABLNAME"
*********************************************************************
PARAMETER cDBF                  && Passed table name if any
IF SET("TALK") = "ON"           && Set and save TALK setting
   SET TALK OFF
   m.talkstat = "ON"
ELSE
   m.talkstat = "OFF"
ENDIF
m.workarea = SELECT()           && Save work area
IF !EMPTY(cDBF)                 && If parameter is passed
   IF USED(cDBF)                && If table is in use
      SELECT (cDBF)             && Select that work area
   ELSE                         && else
      SELECT 0                  && Select an open work area
      USE (cDBF)                && and open the requested table
   ENDIF
ENDIF
IF USED()                       && as long as we have a table

   _CLIPTEXT = "CREATE TABLE " + LOWER(DBF()) + " ("
   =AFIELDS(aFlds)              && populate array with table structure

   * Array Contents  Index
   * --------------- --------
   * Field name        1
   * Field type        2
   * Length            3
   * Precision         4

   * Loop through each row in the array and add the
   * field details to the command

   FOR x = 1 TO ALEN(aFlds, 1)
      _CLIPTEXT = _CLIPTEXT + ;
      LOWER(aFlds(x,1)) + ;
      " " + ;
      aFlds(x,2) + ;
      "(" + ;
      LTRIM(STR(aFlds(x,3))) + ;
      IIF(NOT EMPTY(aFlds(x,4)), ;
      ","+LTRIM(STR(aFlds(x,4))), "") + ;
      ")" + ;
      IIF(ALEN(aFlds,1)<>x,", ","")
   ENDFOR

   _CLIPTEXT = _CLIPTEXT + ")"
ELSE
   WAIT WINDOW NOWAIT "No database in use in this work area"
ENDIF
IF m.talkstat = "ON"
   SET TALK ON
ENDIF
SELECT (m.workarea)          && restore the original work area
RETURN
```

Figure 5: **The program shown here will generate a CREATE TABLE command for the table in the current work area.**

Then the field details are added to _CLIPTEXT iteratively, in a FOR loop. Finally, the closing parenthesis is added, and you have a complete CREATE TABLE command stored in _CLIPTEXT. To get the field information, Mr. Keys uses the AFIELDS() function.

The AFIELDS() function places table structure information into an array. For example, to populate the aFLDS array with table structure information for the FoxPro for MS-DOS help file FOXHELP.DBF, you would use these commands:

```
USE FOXHELP AGAIN
=AFIELDS(aFLDS)
```

The aFLDS array now looks like this:

```
aFLDS(1,1) = "TOPIC"
aFLDS(1,2) = "C"
aFLDS(1,3) = 30
aFLDS(1,4) = 0
aFLDS(2,1) = "DETAILS"
aFLDS(2,2) = "M"
aFLDS(2,3) = 10
aFLDS(2,4) = 0
aFLDS(3,1) = "CLASS"
aFLDS(3,2) = "C"
aFLDS(3,3) = 20
aFLDS(3,4) = 0
```

The first array element contains the name of the first field. The second contains the field type. The third contains the length, and the fourth the number of decimals, if any. These four elements are repeated for every field in the table.

Once the array is created, Mr.Keys's routine scans through the field information, appending each field to the CREATE TABLE command in the appropriate format.

I enhanced Mr. Keys's original GENCRT so that you can optionally pass it the name of another table to use instead of the currently open table. To use this option, issue the command like this:

```
DO GENCRT WITH "INV"
```

In this instance, INV.DBF must be in the current directory or INV must be an active alias.

You can download GENCRT.PRG from PC MagNet. Look for GENCRT.PRG in the Spredsht/DBMS library of the Utilities/Tips Forum.

—*Sal Ricciardi*

GRAPHICS

On the Spot with Separations

TIP Vector-graphics users who want to generate separations for spot (or PMS) colors that also include gradient fills have, until now, been unable to do so. A gradient, say, from PMS 355 to PMS 485 includes many intermediate colors that cannot be represented in spot-color separations, so graphics programs like Corel Corp.'s CorelDRAW automatically convert PMS colors to CYMK (or process) color equivalents.

Finally, though, users of CorelDRAW 5 can produce separations that include true gradient fills using spot or PMS colors. To do so, you must edit the COREL-PRN.INI file (found in the COREL5/CONFIG subdirectory). First find the following statement that controls spot separations:

```
PSSpotFountainsAsProcess = 1
```

Change the value 1 to 0, which effectively turns this feature off. Now CorelDRAW 5 will generate everything from simple two-color gradients to multi-color custom gradients—using PMS inks instead of process colors.

The most common gradients—those that fade to either white or black—require special attention, however. But you can easily create a gradient that changes from a PMS color to black—as long as you remember to select Pantone Process Black from the Colors palette. Ordinary black (defined as 0,0,0 in the RGB color model or 100 percent K in the CYMK color model) won't work.

Generating a gradient from a PMS color to white is even more problematic, because the Pantone palette supplied with CorelDRAW does not include white. I've found, however, that you can create a 1

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	12MB	16MB	20MB	25MB
8Kx8	-	6 50	6 00	5 50
32Kx8	19 00	9 00	8 00	7 00
32Kx8 (3.3V)	-	-	14 50	-
64Kx1	-	11 00	9 00	8 00
64Kx4	-	11 00	9 00	8 00
16Kx4	-	8 00	7 00	6 00
128Kx8	-	59 00	39 00	29 00

Individual D-RAM Chips

MEMORY FOR IBM & APPLE	30NS	80NS	70NS	100NS
1Meg x1	6 85	6 45	5 95	4 95
1Meg x4	58 00	55 00	54 00	-
1Meg x4 (Zip Pin)	24 00	22 00	21 00	-
256x4 Page Mode	7 25	6 75	6 50	5 95
256 4 Static Col	-	9 95	-	-
256x4 Page Zip	9 25	9 00	8 95	-
256x4 Video Zip	-	12 95	11 95	9 95
256x8 SCU	29 00	24 00	-	-
256 x1	3 25	2 95	2 75	2 25
64x4	-	-	3 75	-
64x1	-	-	-	2 80
256x16 SCU	-	-	-	-
256x16 Video Zip	40 00	39 00	-	-

INTEL Math Chips

8087	39 00
8087-2	45.00
8087 1	79 00
80287-XL	49 00
80387 16 DX	39 00
80387 20 DX	44 00
80387 DX (Does All)	74 00
80487 SX (Does All)	249.00
Intel SX (Does All)	89 00
Intel SL Mobil	69 00
Intel 16SX	39 00
Intel 20SX	49 00

Lowest price on Intel overdrive chips

AMBRA

Ambra Pentium 60	4/8/16 Meg	175 00/339 00/699 00
Ambra NC 425SL	2/4/8 Meg	109 00/209 00/449 00
Ambra N Series	4/8/12/16 Meg	189 00/379 00/569 00/929 00
Ambra SN Series	4/16 Meg	189 00/929 00
Ambra Sprinta SLC II	2/8 Meg	89 00/319 00

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- Single chip upgrade solution
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- Compatible with industry standard 386SX CPU socket
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CX486 DRx²-16/32	264 00
CX486 DRx²-20/40	274 00
CX486 DRx²-25/50	314 00
CX486 DRx²-33/66	354 00
CX486 SRX2 16/32	244 00
CX486 SRX2 20/40	249 00
CX486 SRX2 25/50	269 00

SIMM MODULES (Add $5.00 for SIPP)

	40WS	50WS	60WS	70WS	80WS	100WS
1Meg x 9 (3 chip)	-	48 00	42 50	41 00	40 00	-
1Meg x 9 (9 chip)	-	-	46 50	45 00	43 00	39.00
4Meg x 9	-	-	162.00	158.00	146.00	-
16Meg x 9 (9 chip)	-	-	-	680 00	-	-

72 PIN SIMMS (EISA)

256 x 36 1 mg	-	-	-	-	59 00	-
512 x 36 2 mg	-	-	-	96 00	94 00	-
1 meg x 36 4 mg	-	-	184 00	174 00	174 00	-
2 x 36 8 mg	-	-	359 00	339 00	339 00	-
4 x 36 16 mg	-	-	609 00	579 00	599.00	-
8 x 36 32 mg	-	-	1239 00	1229 00	-	-
16 x 36 64 mg	-	-	2699 00	2599 00	-	-
1 x 32 4 mg	-	-	164 00	159 00	-	-
2 x 32 8 mg	-	-	319 00	309 00	-	-
4 x 32 16 mg	-	-	587 00	567 00	-	-

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AST MEMORY

MODEL	AMT UPGRADED	AST PART #	PRICE
Bravo LC 4/25S, 4/33, 4/33S, 4/50, 4/66d	4Meg	500987-002	165 00
	8Meg	500987-003	330 00
	16Meg	500987-004	619 00
	32Meg	500987-005	1399.00
Premium 486/25, 25E, 33, 33E			
Premium 386/33TE 486/25TE 33TE			
Prem Serv Prem II 386SX/20, 25			
Prem II 386/25 386/33, 486/33 486SX/20	8Meg	500780-001	398.00
Premium 386/33T Prem 386SX/16			
Prem II 386SX/20 25	4Meg	500780-004	189 00
Premium 386/25 33, 386/33T, 386SX/16,	1Meg	500780-003	59 00
Prem II 386SX/20,25	1Meg	500780-001	59 00
Premia 4/33S 4/33 4/50 4/66D	8Meg	501159-002	379 00
Premia	16Meg	501159-003	789 00
Premia	32Meg	501159-004	1466 00
Premia	64Meg	501159-005	3111 00
AST Rapid Bd	0–32Meg	500818-001	179 00

72 pin

ZENITH MEMORY MODULES

MODEL	AMT UPGRADED	AST PART #	PRICE
Z386/33 25, 20, 33E	1Meg	ZA3800ME	59 00
Z386/33 25 20 33E 486/25E	4Meg	ZA3800MK	180 00
Z386SX	2Meg	Z-605-1 modules	119.00

MAGNAVOX

286/386SX-16, 386SX-20, 486SX-20 & 386-33 *all are 72PIN SIMM*

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MEMORY BOARDS

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IBM PS/1, PS/2 MEMORY MODULES

IBM PART NO	WORKS WITH MODEL NO.	PRICE
[illegible]	30-286	37 00
[illegible]	30-286 25-286, 50 MTHR BD.	104 00
[illegible]	80-041	79 00
6450179 (2Meg)	80-111 311 121 321 041, 061	84 00
6451080 (4Meg)	80-A21 A41 80-A31 80 111 80-311	189 00
6450604 92G7198 (2Meg)	70-A61 E61 121 A07 A46 A66 A 86	99 00
[illegible]	[illegible]	
6450608 (2Meg)	[illegible]	90 00
78X8955 (12Mb)	[illegible]	35 00
34F2937 (4Meg)	[illegible]	175 00
87F9911 92G7198 (4Meg)	[illegible]	175 00
1057035 (512Kb)	[illegible]	49 00
92F9915 (2Meg)	[illegible]	109 00
92F9694 (4Meg)	[illegible]	189 00
92G7200 (4Meg)	[illegible]	175 00
92G7201 [illegible] (4Meg)	[illegible]	175 00
73G3132 92G7203 (8Meg)	[illegible]	339 00
80G1622 92G7204 (16Meg)	[illegible]	809 00
92G7205 (32Meg)	[illegible]	1239 00
6450960 (2Meg)	[illegible]	90 00
[illegible]	[illegible]	
6450128 92G7200 (4Meg)	[illegible] 486SX 486SX SVR25	175.00
[illegible]	[illegible] 486SX 486SX SVR 85	
[illegible] (8Meg)	[illegible]	339.00
6450130 92G7202 (8Meg)	[illegible]	339.00
[illegible]	[illegible]	
6451158 (4Meg ecc)	[illegible]	189.00
6451159 (8Meg ecc)	[illegible]	399.00
(16Meg ecc)	[illegible]	749 00

IBM NOTEBOOK & LAPTOP MEMORY

8189096 (4Meg)	Thinkpad 500 510CS (3 3 volt)	209 00
8189099 (8Meg)	Thinkpad 500 510CS (3.3 volt)	408 00
8189113 (16Meg)	Thinkpad 510CS (3 3 volt)	809 00
79F0999 (2Meg)	LX40 N33SX PS Note	103 00
79F1000 (4Meg)	LX40 N33SX PS Note, Thpd 350, 350c, PS Note 425	189 00
79F1001 (8Meg)	LX40 N33SX PS Note	369 00
07G1415 (4Meg)	Thinkpad 750 750c 755 380	209 00
07G1416 (8Meg)	Thinkpad 750 750c 755 380	369 00
66G0094 (16Meg)	Thinkpad 750 750c 755 380	849 00
07G1420 (4Meg)	CL57LSX pTp Thinkpad 700 700C, 720 720C	209 00
07G1421 (8Meg)	CL57LSX pTp Thinkpad 700 700C, 720 720C	[illegible]
66G0378 (8Meg)	Thinkpad 350 350c PS Note 425	[illegible]
66G0379 (16Meg)	Thinkpad 350 350c PS Note 425	[illegible]
[illegible] (8Meg)	[illegible]	[illegible]

COMPAQ MEMORY MODULES

MODEL	AMT UPGRADED	CMPQ PART #	PRICE
DeskPro 386/33, 386/33L	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
DeskPro 386S-16MHz	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
DeskPro 286/20E	4Meg Module	112534-001	199 00
DeskPro 386/25E	1Meg Exp Bd	113844-001	149 00
	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]
DeskPro 286N, 386N, 386SX20, all "M" series system LT series, all "T" series	4Meg Module	[illegible]	[illegible]
	1Meg Module	[illegible]	[illegible]
	2Meg Module	[illegible]	[illegible]
	4Meg Module	[illegible]	[illegible]
	8Meg Module	[illegible]	[illegible]
M Series Exp Bd DeskPro 386/16	1Meg	[illegible]	[illegible]
	2Meg	[illegible]	[illegible]
	4Meg	[illegible]	[illegible]
	1.2Meg Bd	[illegible]	[illegible]
	4-8Meg Exp Bd	[illegible]	[illegible]
DeskPro 286	512K Bd	113012-001	49 00
DeskPro 5/90, 5/90M, 5/90M	8Meg Module	[illegible]	[illegible]
Prosignia 5/60	4Meg Bd	[illegible]	[illegible]
Prokant 100 5/60	12Meg Bd	[illegible]	[illegible]
Prokant 2000 4/30 5/66	16Meg Bd	[illegible]	[illegible]
Prokant 4000 4/50 5/66	128Meg Bd	[illegible]	[illegible]
Prolinea 386 3/25S, 3/25ZS	2Meg	[illegible]	[illegible]
	4Meg	[illegible]	[illegible]
Prolinea 486 4/25S, 4/33, 4/50, 4/66, COS	8Meg	161742-001	318 00
Enhanced Prolinea, Prosaria series	2Meg	141683-001	65 00
	4Meg	141684-001	175 00
	8Meg	[illegible]	[illegible]
Prosignia PC Server, 486/33, 486 DX2/66	8Meg	[illegible]	[illegible]
	16Meg	149320-001	829 00
	32Meg	149147-001	1549 00

ALL OF THESE MEMORY MODULES WORK WITH THESE MODELS

COMPAQ LAPTOPS & NOTEBOOKS

LTE/286	4Meg Bd	117081-003	179 00
LTE/386S/20	4Meg Module	121125-002	209 00
LTE/386/20 25 25C	4Meg Module	129769-002	209 00
LTE/386/20 25 25C	8Meg Module	129769-003	409 00
LTE/386/20 25 25C	16Meg Module	129769-004	809 00
LTE LITE 425C/33C/25E/25L	4Meg Module	142337-002	189 00
LTE LITE 425C/33C/25E/25L	8Meg Module	142337-003	349 00
LTE LITE 425C/33C/25E/25L	16Meg Module	142337-004	718 00
SLT/286	4Meg Module	110237-001	219 00
SLT/386	2Meg Module	118304-001	109 00
SLT/386	4Meg Module	118305-001	219.00
Concerto, LTE Elite	4Meg	144790-001	189.00
	8Meg	144790-002	369 00
	16Meg	144790-003	718.00
Contura 320, 325	2Meg	139497-001	99 00
	4Meg	139498-001	189.00
	8Meg	139499-001	339 00
Contura 4/25, 4/25C 4/25CX	4Meg	146529-001	189 00
	8Meg	146521-001	339 00
	16Meg	146521-001	699 00
Aero 4/25 4/33L	4Meg	190532-001	184 00
	8Meg	190597-001	359 00
	16Meg		779 00

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MODEL	AMT. UPGRADED	MANU PART #	PRICE
[illegible]	2Meg	PC14-PA8312U	79 00
[illegible]	2Meg	PC18-PA8317U	79 00
T2000SX T1000LE	4Meg	PC-PA8314U	189 00
[illegible]	8Meg	PC14-PA8315U	359 00
[illegible] T1800 1850 C	2Meg	PC PA2000U	79 00
[illegible] T1800 1850 C	4Meg	PC PA2001U	189 00
[illegible] T1800 1850 C	8Meg	PC-PA2002U	359 00
T4400SX SXC T6400 T6600	4Meg	PC-PA2004U	189 00
T4400SX SXC T6400 T6600	8Meg	PC-PA2005U	359 00
T4400 [illegible] T1600	1Meg	PC-PA2010U	599 00
[illegible] T1900 T1910	4Meg	PC-PA2012U	299 00
[illegible] T1900 T1910	8Meg	PC-PA2013U	389 00
[illegible] T1900 T1910	16Meg	PC-PA2014U	729 00
[illegible]	8Meg	PC PA2008U	268 00
[illegible]	16Meg	PC PA2009U	699 00
[illegible] T2400 T3600	4Meg	PC-PA2019U	194 00
[illegible] T2400 T3600	8Meg	PC PA2020U	369 00
[illegible] T2400 T3600	16Meg	PC-PA2021U	763 00
[illegible]	32Meg		1549 00
[illegible]	2Meg	PC13-PA8306	99 00
[illegible]	2Meg	PC8-PA8307U	89 00
[illegible]	2Meg	PC8-PA8308	139 00
[illegible]	2Meg	PC8-PA8309	199 00
[illegible]	2Meg	PC1-PA8310	79 00
[illegible]	4Meg	PC1-PA8311	119 00
[illegible]	4Meg	PC1-PA8809	199 00
[illegible]	2Meg	PC1-PA8318	179 00
[illegible]	2Meg	PC1-PA8319	199 00
[illegible]	2Meg	PC PA8301C	95 00
350 [illegible] T8500	2Meg	PC1C-PA8314U	114 00
[illegible]	8Meg	PC1C-PA8315U	419 00

NOTEBOOK, LAPTOP MEMORY

MODEL	AMT UPGRADED	MANU PART #	PRICE
[illegible]	[illegible]		[illegible]
[illegible]	[illegible]		[illegible]
[illegible]	[illegible]		[illegible]
[illegible]	4Meg 8Meg	12407000	[illegible]
[illegible]	[illegible]		[illegible]
[illegible]	4Meg 8Meg	501255-001 -002	[illegible]
AST Notebook Prem Exec 386SX 20/25/25L	4Meg	500814-003	189 00
AST Power Exec 325C 425SL 425SL	4Meg	501169-001	189.00
AST Power Exec 325C 425SL 425SL	4Meg	501166-003	819 00
AST Power Exec 433SL	4Meg/16Meg	801318-001 002	194 769
AT&T Safari 486J/W	2Meg	PEC 37001	258 00
Bondwell 331J Plus	1Meg	230055-001M	109 00
Bondwell 331DV SX	2Meg		109 00
Bondwell 331DV SX	4Meg		229 00
Canon Innova 486	2Meg 4Meg 8Meg		109/209 449
Canon Innova 486 10	4Meg		199 449
[illegible] 486	4Meg		199 449
[illegible]	4Meg		199 449
[illegible]	4Meg		199 00
[illegible]	4Meg	A808511	199 00
[illegible]	4Meg	PCA 00053-0001	199 00
[illegible]	4Meg		194 399
[illegible]	4Meg		199 199
[illegible]	4Meg		199 199
[illegible]		S386-4M	149 00
[illegible]			59 00
[illegible] 480	2Meg 4Meg		129 769
Magnavox Metalite	1Meg 4Meg	286 386SX	159 199
[illegible]	4Meg 8 Meg		229 449
NEC Prospeed 386	1Meg	PC31-21	119 00
NEC Prospeed 386	2Meg	PC31-22	199 00
[illegible] 386SX 16 386SX 20	1Meg	PC21-21, PC41-21	79 00
[illegible] 386SX 20	4Meg	PC21-22, PC41-22	149 00
[illegible]	4 Meg 8Meg	CP4104	153/359 795 989
[illegible] Hard Drive	340Meg 540Meg		99 199
[illegible]			[illegible]
[illegible] 286	1Meg 4Meg	286, 386SX	129 199
[illegible]	2Meg 8Meg		119 369
[illegible] 1770	1Meg	CF-BA105	79 00
[illegible]	2Meg 4Meg		119 199 309
Panasonic CF-W2HF CF-S8U	4Meg 8Meg		219 819
Sahyo CT 16 165	2Meg	MBC-486MEM2	109 00
Sharp 6781 6881 6785 6700 6800, 6741	2Meg 4Meg		109/399
[illegible] 7760	4Meg		199 799
[illegible]			79 00
[illegible] Dataword	2Meg 8Meg	CE 621B	79 00
[illegible]		NB386SX 20	119 429
[illegible]		2568034-0001	79 00
[illegible]		2568900-1	84 00
[illegible]	4Meg 8Meg		199 999
[illegible]			215 799
[illegible] 381	4Meg		119 429
[illegible] 383C	2Meg 4Meg		119 429
[illegible] 486SX DX Tandy 486	4Meg 8Meg		249 859
[illegible]	4Meg 8Meg		249 459 899
[illegible]			[illegible]
Zenith Master Sport 386SX	2Meg	ZA-300-1	74 00
Zenith Master Sport SL SLE 600 620 625SL	2Meg	ZA-8-4	119 00
[illegible] 286	2Meg	ZA-180-06	99 00
	2Meg	ZA-180-04	149 00
	2Meg	ZA-180-08	149 00
	2Meg	ZA-180-07	149 00
[illegible]	2Meg	ZA3250-4/5	159 419
[illegible] 425 SL LXC LMC LXP	4-8-16Meg		209 459 839
Zenith Z Star 4/33	2Meg		119/419

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S-RAM Cards 2MEG	189 00	Lan Ethernet (Coax)	159 00
14.400/14.400 Data/Fax Modems	189.00	Visual Media (CD Rom, Tape Dr)	249 00
Readwriter Card	199 00	Bus Toaster™ (High speed SCSI II)	249.00
		Wavjammer™ (16 bit stereo sound card)	279
		105 Mg Hard Drive	399 00

FLASH MEMORY 2 5Meg–219.00 5 Meg–299.00 10Meg–459.00 20Meg–749.00

LASER PRINTER MEMORY UPGRADES

AMOUNT UPGRADED	DE Bd	256K	1	2	3	3.5	4	5	6	8	16	32
Canon LBP 430	-	-	89	-	-	-	189	-	-	-	-	-
Canon LBP 860	-	-	-	99	-	-	179	-	-	349	699	1249
Canon LBP4 4Lite 4plus	-	-	169	279	-	-	-	-	-	-	-	-
Epson 6000 Action Laser	-	-	-	139	-	-	229	-	-	-	-	-
Epson Action Laser II	-	-	99	-	209	-	-	327	-	-	-	-
Epson 8000	-	-	89	-	249	-	-	327	-	-	-	-
Hewlett Packard												
HP 2, 2D	-	-	-	79P	-	-	-	239P	-	Call	-	-
HP 3, 3D, 3P, 2P, 2P+	-	-	-	189	-	-	-	189	-	-	-	-
HP 4, 4M, 4M, 4M+, 4P, 4MP	-	-	-	89	-	-	-	189	-	349	-	-
HP 4L	-	-	-	-	-	-	-	-	-	-	-	-
HP 5Si	-	-	89	-	-	-	189	-	-	349	-	-
HP 4Si	-	-	-	89	-	-	179	-	-	349	-	-
HP Design Jet 600, 680	-	-	-	-	-	-	175	-	-	349	-	-
HP Deskjet 500, 500C, 510, 500J, 550	89	-	-	-	-	-	-	-	-	-	-	-
HP Deskjet 1200C 1200C/P	-	-	-	89	-	-	175	-	-	349	-	-
HP Paintjet XL300	199	-	-	-	-	-	199	-	-	499	837	-
IBM Laser 4019 4019E	-	-	-	-	-	199	-	-	-	-	-	-
IBM Laser 4029 4037	-	-	-	-	-	-	199	-	-	-	-	-
IBM Laser 4039, 4079	-	-	-	-	-	-	199	-	-	350	-	-
NEC 90, 290	-	-	99	-	-	-	-	-	-	-	-	-
NEC 95, 97	-	-	139	-	-	-	-	-	-	-	-	-
Oki 400	-	-	89	-	-	-	169	-	-	349	-	-
Oki 400E, 400EX, 410E, 410EX	-	-	84	-	-	-	179	-	-	349	-	-
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percent tint of a PMS color and use that in place of white.

Those who are still using CorelDRAW, Version 4.0—or even CorelDRAW, Version 3.0—will have to resort to workarounds. Here's the simplest approach: You can substitute any of the process colors (first ensuring that they are not already used in your drawing) for the spot colors. Within the drawing, you'd create gradients using process magenta and cyan, for example. After the separations are generated, you'd substitute PMS-355 and PMS-485 inks for the process inks. There are some drawbacks to this method. For example, you can't use the four-color process *and* spot colors—so six-color custom-printing jobs are out of the question. And you'll have to tell (and remind!) your printer to make the ink substitution. But the technique does work.

Yet another solution involves using duplicate objects. First, assign a gradient fill running from a PMS color to a 1 percent tint of the same PMS color. Create a duplicate object, and assign a gradient fill to the duplicate running from the second PMS color to a 1 percent tint, but reverse the direction of the gradient fill. Use CorelDRAW's Align function to stack the two objects over one another precisely. When you generate the spot-color separations, these two objects will overprint each other and the colors will mingle.

Bruce W. Kletz
Gaithersburg, Maryland

▶PC MAGAZINE: This is a great tip, with lots of applicability. For example, printing a three-color job (that consists of black and two spot colors) is often cheaper than printing standard four-color process separations. In addition, this is a great technique for anyone designing for the packaging or textile markets, which still rely heavily on PMS rather than on process colors.

Let me clarify an important point concerning Corel Corp.'s CorelDRAW 5. You should only have to edit the CORELPRN.INI file when you want to generate spot-color separations containing a gradient fill that includes two or more PMS colors. Like previous versions of the program, CorelDRAW 5 should be able to generate spot-color separations with gradient fills containing only tints of a single PMS color (the case when you fade a PMS color to white or to a 1 percent tint). The current release of CorelDRAW 5, however, contains a bug that can only be circumvented by making the change Mr. Kletz suggests. Revision B, which should be shipping by the time you read this article, fixes this and several other bugs. For more information, call Corel at 800-836-3729.

I tested these workarounds for use with earlier versions of CorelDRAW, and they do indeed work. I did discover one small glitch with the instructions. By default, CorelDRAW creates a knockout (or drops the color) for any underlying objects, so that printing inks don't interfere with one another on press. In this case, you want exactly the opposite effect: You *want* the colors to overprint in order to create a transition from one PMS ink to the other. To surprint one object on another, select the topmost object and click the right mouse button. When the Object menu appears, click the Overprint Fill option.

The only drawback that I can identify concerns screen previews. It doesn't matter whether you're temporarily substituting process colors for PMS colors or whether you are stacking two opaque objects over one another; the screen previews will not match the final printed pages. In both cases, you never actually *see* the true gradient until you generate separations and go to press.

Note that cyan, yellow, magenta, and black process inks are specially formulated to adhere to the paper—and to each other—as they overprint. In addition, they are all based on transparent dyes, which allow for smooth optical color mixtures. In other words, process inks are well suited for printing gradient fills.

In contrast, PMS or spot-color inks can vary dramatically in composition and viscosity (the technical term for an ink's stickiness; this determines how well an ink will overprint other colors). In addition, a PMS color can be pigment-based, which means that instead of transparent dyes the ink contains opaque particles of color. For these reasons, printing two PMS colors over each other can give you unexpected results—like mottling, banding, or poor ink adhesion. Before you choose two PMS colors for this effect, ask your printer for advice on ink chemistry.—*Luisa Simone*

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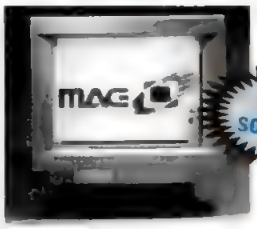

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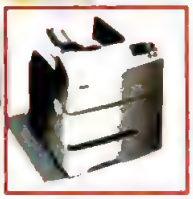

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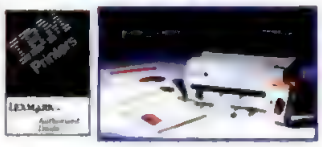

● 600 x 300 dpi with enhancement ● Fast 300 cps print speed (black) ● 4 minutes per page (color) ● Includes ColorFine Windows™ drivers for vivid output ● Automatic sheet feeder, 150 sheets of paper or 15 envelopes ● 2 year LexExpress Warranty: next business day exchange via overnight delivery

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- Flash ROM field upgradeable
- Includes data/fax software for Windows™
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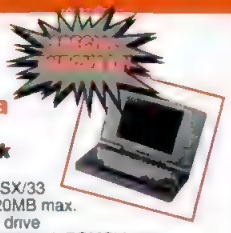
Canon



Canon Innova Book 10C

Color subnotebook computer

- SL-enhanced Intel 486SX/33 CPU
- 4MB RAM std., 20MB max.
- 170MB or 260MB hard drive
- Passive-matrix color display
- PCMCIA slot 1) Type II
- Weight. 4 0 lbs

170MB .....**$1399.00** CDW 41[illegible]

260MB .....**$1499.00** CDW 41[illegible]

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5 User CD	776.57
10 User CD	1765.90
25 User CD	2588.41
50 User CD	3459.78
100 User CD	4784.61

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5 User 3.5"	595.24
10 User 3.5"	1349.62
25 User 3.5"	1969.46
50 User 3.5"	2688.00
100 User 3.5"	3599.84

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PERSONAL NETWARE V1.0

1 User	59.86
5 User	299.52

NOVELL PRICING IS SUBJECT TO CHANGE. PLEASE CALL CDW FOR THE MOST CURRENT PRICING.

THOMAS-CONRAD

TC5143 Ethernet coax	[illegible]
TC5143 Ethernet coax 6pk	[illegible]
TC5143 Ethernet 10BT	[illegible]
TC5143 Ethernet 10BT 6pk	[illegible]
TC6242 ARCNET 8 bit coax	[illegible]
TC6245 ARCNET coax	[illegible]
TC6040 ARCNET passive 4 port hub coax	[illegible]
TC5055 Ethernet 8 port hub 10BT	[illegible]
TC4045 Token Ring 16/4	[illegible]

ARTISOFT

NodeRunner 2000A	215.58
NodeRunner 2000T	169.05
NodeRunner 2000C	169.05
NodeRunner/SI 2000A	87.13
NodeRunner/SI 2000T	73.62
NodeRunner/SI 2000C	73.62
LANtastic V6.0	79.50
LANtastic V6.0 5 user	322.90
LANtastic V6.0 Starter Kit	229.13
Central Station II	389.13
Simply LANtastic starter kit	163.79
T-Runner 8 port 10BT	187.35
T-Runner 12 port 10BT	217.35

SMC®

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Ultra16 coax 6pk	509.88
Ultra16 Ethernet 10BT	96.10
Ultra16 10BT 6pk	459.23
Ultra16 10BT 24pk	1573.71
Ultra16 Ethernet combo	108.99
Ultra16 combo 6pk	568.15
Ultra16 combo 24pk	1977.30
EtherCard+ Elite coax	119.64
EtherCard+ Elite coax 6pk	628.73
EtherCard+ Elite 10BT	119.12
EtherCard+ Elite 10BT 6pk	618.61
EtherCard+ Elite combo	139.57
3608 Ethernet 8 port hub 10BT	298.85
3512 Ethernet 12+2 port hub 10BT	548.55
PC600WS ARCNET coax	119.93
PC650WS ARCNET TP	119.88
ARCNET 8 port active hub coax	229.41
TokenCard Elite 16/4	249.88

3Com®

3C503 Etherlink II coax	[illegible]
3C5[illegible] Ether[illegible] coax	[illegible]
3C509 Etherlink III coax 5pk	489.02
3C509 Etherlink III 10BT	115.50
3C509 Etherlink III 10BT 5pk	447.38
3C5[illegible] Etherlink [illegible] combo	[illegible]
3C509 Etherlink III combo 5pk	532.84
3C579 Etherlink EISA coax	[illegible]
3C579 Etherlink EISA 10BT	229.[illegible]
3C1627 12 port Linkbuilder 10BT	609.94

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Eagle NE2000+ coax	78.63
Eagle NE2000+ 10BT	89.45
Eagle NE3200 coax w/TPA	429.61
National Semi NE2000+ coax	76.16
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PE3108Z pocket Ethernet coax	267.80
PE3108T pocket Ethernet 10BT	268.31
Pocket Token Ring III	455.89
PPX03 Parallel port multiplexor	77.80

IBM TOKEN RING

IBM Token Ring 16/4 ISA	319.62
IBM Token Ring 16/4 MCA	499.56
IBM Token Ring MAU	429.80

intel

EtherExpress PRO/10 Flsh 10BT	115.07
EtherExpress PRO/10 Flsh 10BT 5pk	482.72
EtherExpress PRO/10 Flsh combo	115.07
EtherExpress PRO/10 Flsh combo 5pk	505.98
EtherExpress 16 coax	99.33
EtherExpress 16 coax 5pk	454.13
EtherExpress 16 10BT	99.33
EtherExpress 16 10BT 5pk	454.13
EtherExpress 16 10BT 20pk	1698.38
EtherExpress MCA 10BT	166.52
EtherExpress 16 combo	116.77
EtherExpress 16 combo 5pk	549.72
EtherExpress Flash 10BT	111.88
EtherExpress Flash 10BT 5pk	515.62
EtherExpress Flash combo	129.79
EtherExpress Flash combo 5pk	619.73
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ASP

ASP COMPUTER PRODUCTS INC

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Multiprotocol 4 printer server combo	499.82
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Powertape 2.4GB SCSI external	1077.99
PowerDAT 4GB SCSI internal	1127.79

iOMEGA

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Bernoulli 150MB internal SCSI	413.03
Bernoulli 150MB internal IDE	389.71
Bernoulli 150MB PC Powered	449.38
Bernoulli 150MB Transportable	469.84
Bernoulli 230MB Insider	454.44
Bernoulli 230MB Transportable	484.44
150MB cartridge	92.80
230MB cartridge	98.81

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Backpack 5.25" 1.2MB floppy parallel	165.38
Backpack 340MB HD parallel	439.75
Backpack 2X CD-ROM parallel	344.44
Backpack 250MB tape backup parallel	299.90

SyDOS

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Puma 88MB parallel	442.44
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SideCar II 305MB parallel	313.53
1200-4 4GB SCSI external	2045.39

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Wyse 55 amber/green/white	223.21
Wyse 55 amber/green/white	223.21
Wyse 60 amber/green/white	279.50
Wyse 150 amber/green/white	265.45
Wyse 160 amber/green/white	329.88
Wyse 325 color	427.40

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Edutainment CD 2X kit internal	448.95
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SoundBlaster 16 ASP SCSI-2	198.95
SoundBlaster 16 AWE32	298.95
SoundBlaster 16 MCD	148.95
SoundBlaster 16 SCSI-2	178.95
SoundBlaster 16 value edition	99.89
SoundBlaster Pro value edition	74.95
SoundBlaster value edition	55.95

Chinon CDS535 CD-ROM kit internal	249.73
Chinon CDX535 CD-ROM kit external	349.64
Diamond Quad CD kit internal w/sound	514.51
Ensoniq Soundscape wavetable	198.88
Logitech SoundMan Wave	119.49
Media Magic CD 2X kit int	149.88
Media Magic CD 2X kit int. w/DSP16 sound	309.86
Mitsumi CD 2X kit internal	135.76
Mitsumi CD 2X kit internal w/sound	194.87
NEC 2Vi	179.42
NEC 2V Deluxe	298.98
NEC 3Xp Plus	398.62
NEC 3Xp Plus Kit	469.39
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NEC 4Xi Kit	469.39
NEC 4Xe	499.34
NEC 4Xe Kit	559.80
NEC 4X Pro	697.80
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Plextor 4plex quad internal	436.48
Sigma Designs RealMagic Lite	280.93
Sony CDU-33A 2X internal SCSI	129.87
Sony CDU-55S 2X internal SCSI	219.84
Sun Moon Star CD 2X kit internal	146.79
Sun Moon Star CD 2X kit internal w/sound	214.93
Teac SuperQuad 4X internal	339.81
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Toshiba 3401 SCSI CD-ROM internal	289.94
Toshiba 3401 SCSI CD-ROM kit external	529.80
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DB III 12X12 16 button	248.90
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Slate 12X12 16 button	348.98

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Summagraphics.

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ScanJet IIP document feeder	269.93
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ScanJet IICX document feeder	474.72
ScanJet IICX transparency adapter	633.28

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Mag Innovision MX17FG	829.85
Mag Innovision MX21F	1686.52
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Magnavox CM2099 14" .28 NI	258.80
Magnavox CM2015 15" 1024	298.89
Magnavox CM4015 15" 1280	358.85
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NEC XP 15"	676.79
NEC XP 17"	1257.72
NEC XP 21"	2478.48
Sony 15SF 15"	447.02
Sony 17SE1 17"	969.88
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ATI Graphics Xpression ISA 2MB	209.20
ATI Graphics Xpression VLB 2MB	209.20
ATI Graphics Xpression PCI 2MB	209.20
ATI Graphics Pro Turbo ISA 2MB	389.79
ATI Graphics Pro Turbo VLB 2MB	389.79
ATI Graphics Pro Turbo PCI 2MB	389.79
ATI Graphics Pro Turbo PCI 4MB	599.00
Diamond SpeedStar Pro ISA 1MB	95.69
Diamond SpeedStar 64 ISA 2MB	199.00
Diamond Stealth 32 VLB 2MB	174.99
Diamond Stealth 64 VLB 2MB VRAM	348.88
Diamond Stealth 64 PCI 2MB VRAM	348.88
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Hercules Dynamite Pro ISA 2MB	197.48
Hercules Dynamite Pro VLB 1MB	149.36
Hercules Dynamite Pro VLB 2MB	197.48
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Hercules Terminator 64 VLB 2MB	379.88
Intel Smart Video Recorder Pro	416.99
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T1960CT 200MB act color	2734.81
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T2400CS 250MB dual color	2734.81
T2400CS 320MB dual color	2859.88
T2400CT 250MB act color	3325.97
T2400CT 320MB act color	3448.83
T3400CT 250MB act color	2867.06
T3600CT 250MB act color	3448.73
T4700CT 200MB act color	3955.80
T4700CT 320MB act color	4208.84
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Versa S 4/33S 210MB pas color	1895.87
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Versa M 4/75 340MB true clr	5124.46
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Versa M 4/75 540MB hi-res clr	5598.54
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Versa M 4/100 540MB hi-res color	5899.84
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Versa M 4/100 810MB hi-res clr	6449.88
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ML395	987.32	OL410E	647.84
ML395C	1039.74	OL410E/PS	
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*includes $75 manufacturer rebate (ends 12.31.94)

Canon

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Digital Corporation

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2023	182.27		

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microLaser Pro 600 PS65	1524.25
microLaser Pro E	1395.49
microLaser Power Pro 600 PS65	1629.80

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DeskJet 560C	479.89
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COSTAR

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2210A 1050MB IDE	734.97
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4110 1050MB SCSI	669.65
2217 1.7GB SCSI	1038.46
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1936 3GB SCSI	1899.69

CONNER

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425MB IDE	231.43	1.27GB IDE	584.83
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Adaptec 2742AT EISA SCSI-2	339.22
Adaptec 2842 VLB SCSI-2	257.23
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U.S. Robotics

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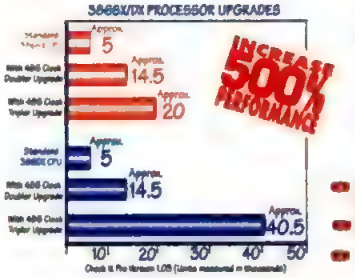

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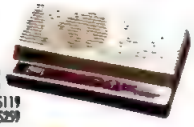

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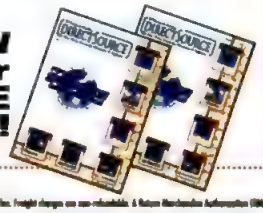

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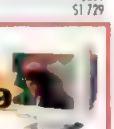

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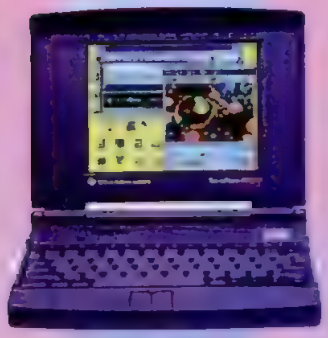

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Model	RAM	Hard Drive	Price
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4/50s Model 273W	8MB	270MB	$1319
4/66d Model 273W	8MB	270MB	$1579
4/66d Model 543W	8MB	540MB	$1669

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- ▲ 3-Year Warranty

Model	Hard Drive	Price*
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486DX2/66 All-In-One	420MB	$1499
486DX2/66 Desktop	420MB	$1589
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- ▲ 24/96 fax modem
- ▲ MS-DOS, Windows, Quicken
- ▲ CD titles: Compton's Encyclopedia, PFS Window Works

Processor	Hard Drive	Price*
486SX/33 desktop	270MB	$1299
486DX2/66 desktop	340MB	$1539
486DX2/66 minitower	420MB	$1639
P60 Minitower	420MB	$2219

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- ▲ Large built-in trackball
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- ▲ Energy Star compliant
- ▲ MS DOS 6.0, Windows 3.1

Processor	RAM	Hard Drive	Price
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486SX2/50	4MB	270MB	$1169
486DX2 66	4MB	420MB	$1499
486DX2 66	4MB	525MB	$1639
486DX4/100	8MB	420MB	$1999

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- ▲ Integrated trackball
- ▲ MS-DOS 6.0, Windows 3.1, MS Video for Windows Runtime

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Processor	Display	Hard Drive	Price
486DX2/40	9.5" Dual scan	170MB	$3119
486DX2/40	8.4" Active	170MB	$3779
486DX2/40	8.4" Active	340MB	$4159
486DX2/50	9.5" Mono	250MB	$3299
486DX2/50	9.5" Active	340MB	$4999
486DX4/75	9.5" Active	340MB	$5669
486DX4/75	9.5" Active	510MB	$6139

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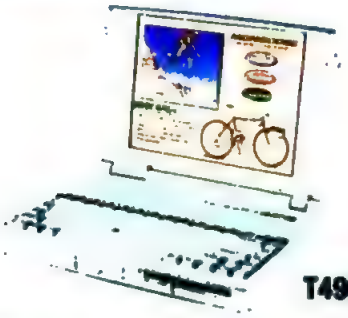

T4900

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- ▲ Ballpoint mouse with Quickport (T1900)
- ▲ Accupoint pointing device (T2400)
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T1910	486SX/33	9.5" Mono	200MB	$1499
T1910	486SX/33	9.5" Dual Scan	200MB	$2039
T1960	486DX2/50	9.5" Dual Scan	200MB	$2379
T1960	486DX2/50	9.5" Dual Scan	320MB	$2629
T1960	486DX2/50	8.4" Active	200MB	$3029
T1960	486DX2/50	8.4" Active	320MB	$3259
T2400	486DX2/50	9.5" Dual Scan	250MB	$2929
T2400	486DX2/50	9.5" Dual Scan	320MB	$3089
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T2400

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T3600CT	486DX2/50	8.4" Active	250MB	$4069

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- ▲ MS-DOS, UltraFont, Indeo video compression software, Windows for Workgroups 3.11

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Model	Processor	Screen	Hard Drive	Price
T4700	486DX2/50	9.5" Active	200MB	$4549
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T4700

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XJ2144	14.4/14.4 XJACK GOLD	$249.99
CC4144	14.4/14.4 PCMCIA GOLD	$249.99
XJ2288	28.8/14.4 XJACK	$449.99
CC3288	28.8/14.4 PCMCIA	$449.99

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- TrackPoint II integrated pointing device
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Screen	Hard Drive	Price
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9.5" Monochrome	340MB	$2229
9.5" Dual Scan	170MB	$2279
9.5" Dual Scan	340MB	$2659
8.4" Active Color	170MB	$2719
8.4" Active Color	340MB	$3099

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Processor	RAM	Screen	Hard Drive	Price
486DX2/50	4MB	9.5" Mono	200MB	$1699
486DX2/50	4MB	9.5" Dual Scan	200MB	$2179
486DX2/50	8MB	9.5" Dual Scan	340MB	$2549
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- Detachable video display
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- Integrated trackball
- Two Type II or one Type III PCMCIA slot
- MS-DOS Windows for Workgroups, Microsoft Sound System
- 3-Year Warranty

Processor	RAM	Screen	Hard Drive	Price
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486DX2/50	4MB	10.3" Dual Scan	340MB	$3149
486DX2/50	4MB	9.5" Active	340MB	$4339
486DX2/50	8MB	9.5" Active	450MB	$4759
486DX4/75	8MB	9.5" Active	520MB	$5339

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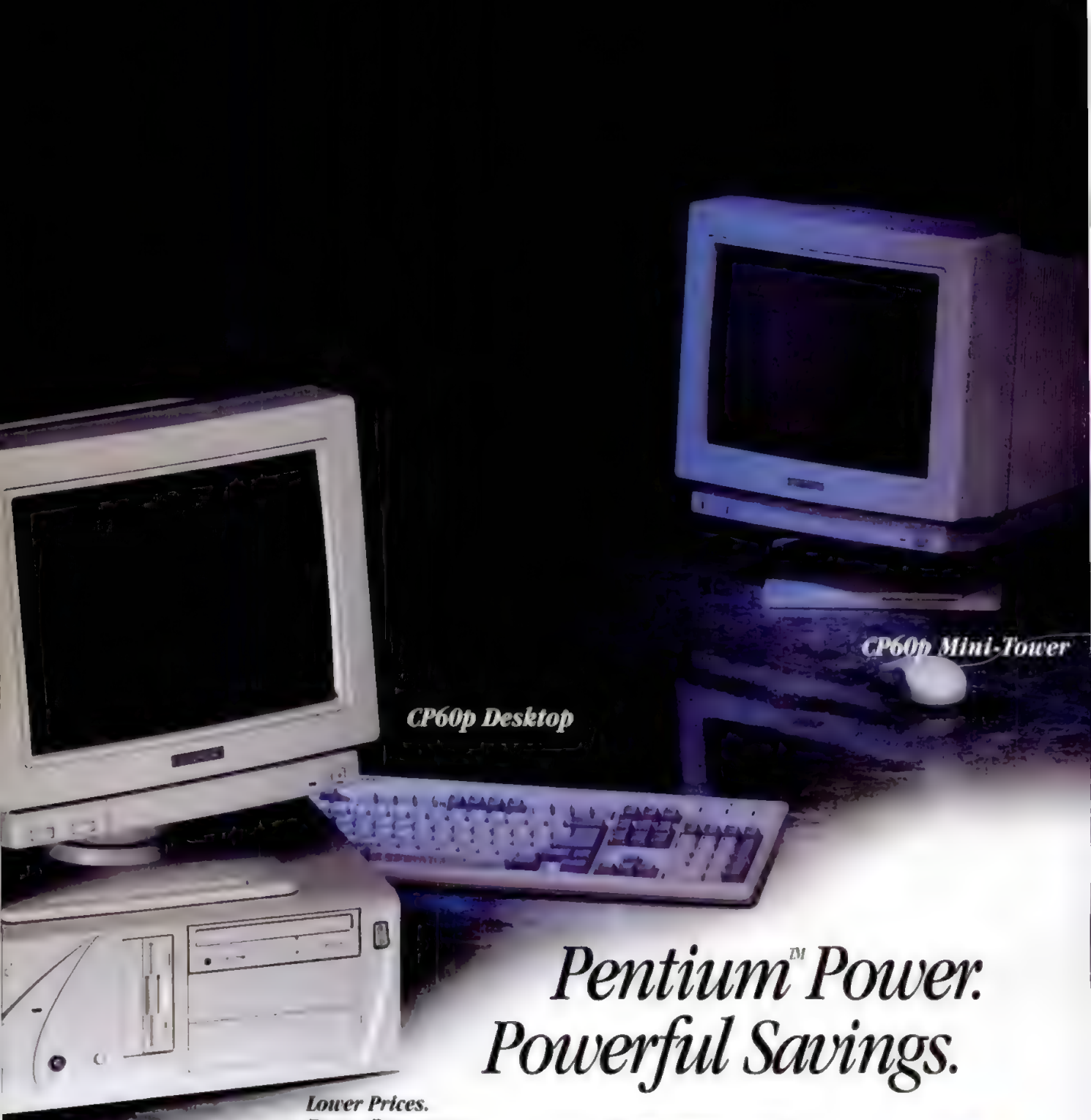

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Cache	256KB	256KB	256KB	256KB
Hard Drive	212MB	420MB	420MB	1GB
Expansion	8 Slots, 3 with PCI	8 Slots, 3 with PCI	8 Slots, 3 with PCI	8 Slots, 3 with PCI
Monitor	14" N-I	15" N-I	15" N-I	14" N-I
Video	1MB PCI	1MB PCI	1MB PCI	1MB PCI
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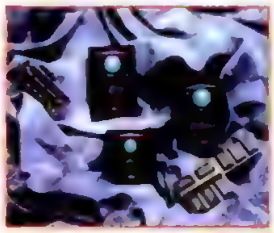

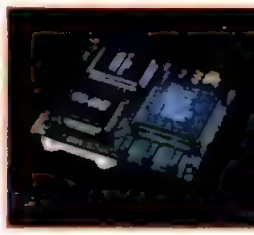

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Austin Notebooks

- Intel 486™SX, DX2 or DX4 Processors
- 4 MB or 8 MB RAM Expandable to 32 MB
- 262 MB to 703 MB IDE Drive, User Replaceable
- 3.5" 1.44 MB Diskette Drive
- Local Bus Video with 1 MB VRAM
- Local Bus IDE
- 9.5" Monochrome, DSTN or TFT Active Color Screen
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- Premium Notebook Carrying Case
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- Desktop chassis
- 101-Key Keyboard & MS Mouse
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- 3.5" 1.44 MB Diskette Drive
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- Intel 60MHz Pentium Processor
- 256 KB L2 cache
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- Double Speed CD-ROM
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- Desktop chassis
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intel inside pentium processor

September '94 March '94 May '94

Austin Direct puts more firepower into its systems — featuring the world's fastest PC processor, the Intel Pentium. Your computing intensity is maximized with 8 megabytes of RAM, a 32-bit PCI bus, and a 256KB cache. There's a PCI-bus Windows accelerator with 2MB DRAM because today's business applications, graphics, and even games, demand faster video processing. Your top-end Austin Power system gives you the best performance for all your PC software. Austin Direct and the Intel Pentium: quality you can count on and available now!

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UNBEATABLE PRICES ON AUSTIN'S POPULAR i486™ SYSTEMS

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- Intel 66MHz 80486DX2 Processor
- 128 KB L2 cache, expands to 256K B
- 3.5" 1.44 MB diskette drive
- Double-speed CD-ROM
- Local bus windows accelerator with 1 MB
- 14" SVGA monitor, .28mm non-interlaced
- 7 16-bit ISA slots, 2 with 32-bit VL-Bus extensions (PCI also available)
- Desktop chassis
- 101-keyboard & MS Mouse
- MS-DOS 6.22, Windows 3.11 & MS Works 3.0
- Energy Star compliant

$1,799 Lease $62/mo

- 8 MB RAM, Expandable to 64 MB
- 425 MB IDE Hard Drive
- 14" SVGA monitor, .28mm

$1,899 Lease $66/mo.

- 8 MB RAM, Expandable to 64 MB
- 540 MB IDE Hard Drive
- 14" SVGA monitor, .28mm

$2,099 Lease $73/mo

- 8 MB RAM, Expandable to 64 MB
- 1 GB Hard Drive (PCI) Only
- 14" SVGA monitor, .28mm

EXPLORA 466

- Intel 66MHz 80486DX Processor
- 128 KB L2 cache, expands to 256 KB
- 3.5" 1.44 MB diskette drive
- Local Bus Windows Accelerator with 1 MB
- 7 16-bit ISA slots, 2 with 32-bit VL-Bus extensions
- Double-speed CD-ROM
- MediaMagic T32 audio card
- Desktop chassis with integrated speakers
- 101-keyboard & MS mouse
- MS-DOS 6.22, Windows 3.11 & MS Works 3.0
- CD Titles. Compton's Interactive Encyclopedia, Interplay's 10 Year Anthology

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- 8 MB RAM, Expandable to 64 MB
- 425 MB IDE Hard Drive
- 14" SVGA Monitor, .28mm

New!

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- 128KB cache
- 3.5" 1.44 MB diskette drive
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- 5 16-bit ISA slots
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- MediaMagic 16-bit audio card with speakers
- Video playback using MPEG1
- Space-saving chassis
- 101-keyboard & MS mouse
- MS-DOS 6.22, Windows 3.11 & MS Works 3.0
- Compton's Interactive Encyclopedia (MPEG)

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- 14" SVGA Monitor, .28mm

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- 128 KB cache
- 3.5" 1.44 MB diskette drive
- Local bus windows accelerator with 1 MB
- 5 16-bit ISA slots
- Space saving chassis
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Custom configurations are available for all Austin Direct computers. Ask your sales representative for details.

intel inside

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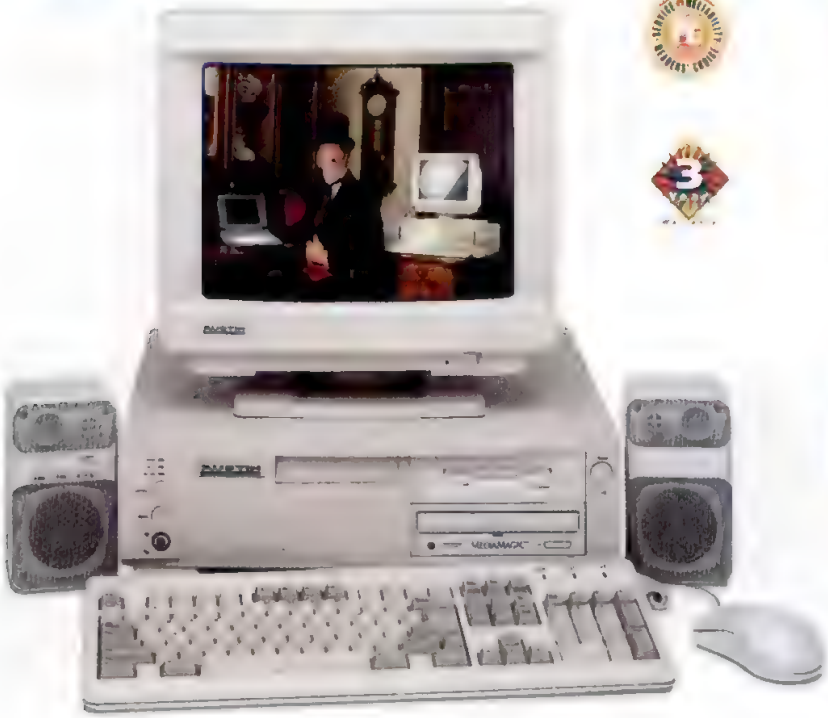

Fast moving PCs that stay ahead of even the most serious workload, Genesis and Premier, two 486-powered PC product lines designed for value and performance. Both systems comply with EPA requirements for conservation and Energy Star designation, feature 128KB Level 2 Cache, and arrive ready to run with Windows 3.11, DOS 6.22, and Microsoft Works installed.

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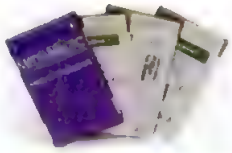
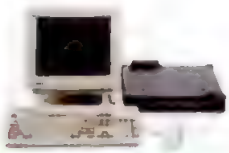
NOTEBOOK AND DESKTOP UPGRADES.





NOTEBOOK UPGRADES

Docking Station
This desktop docking station transforms your Austin notebook into a full-fledged PC system, providing 1 ISA slot, VGA, keyboard and mouse ports.
Austin Docking Station $299

PCMCIA Audio Card
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Maximizie your Austin notebook with this custom-designed carrying case. Room for cables, extra battery, the works.
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Austin Ballistic Nylon w/Leather Trim Travel Case. $129

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Austin Desktop Bundle $699

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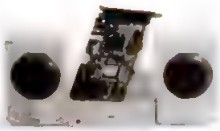

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Install a CD-ROM, 16-bit sound card, and stereo speakers. Your PC is ready to blast you out of your chair.
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Save an extra drive bay for CD-ROM by combining both 3.5-inch and 5.25-inch drives in one unit.
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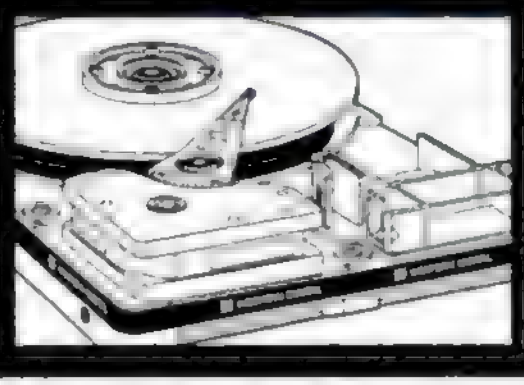

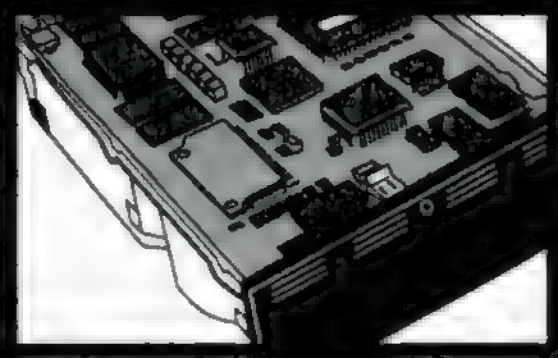

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#1 IDE drives. 3 year warranty, 64K cache.

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MegaHaus unbeatable price! WIDE SCSI in stock.

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JAPANESE QUALITY! INCREDIBLE PRICE!

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530MB	3.5"	13.8ms	SCSI	2yr wty.	$245
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6 Disc	Double Speed	DRM602X	$439
6 Disc	Quad Speed	DRM604X	$989
18 Disc	Quad Speed	DRM1804X	$1899

HARD DRIVES

CONNER

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420MB	14ms	CFS420A	$205
850MB	10ms	CNR850A	$419
1275MB	9ms	CNR1275A	$539

Maxtor

IDE			
135MB	12ms	M7135AV	$139
270MB	12ms	M7270AV	$162
420MB	12ms	M7420AV	$198
540MB	12ms	M7540AV	$245

MICROPOLIS

IDE			
1050MB	10ms	MC4110A	$570
1740MB	10ms	MC2217A	$889
SCSI			
1052MB	8.5ms	MC4110	$570
1740MB	10ms	MC2217	$889
2050MB	8.5ms	MC4221	$1325
3020MB	11ms	MC1936	$1659
4294MB	8ms	MC3243	$2189
9100MB	12ms	MC1991	$3459
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1000MB	10ms	MC4110AV	$639
1700MB	10ms	MC2217AV	$989
2000MB	8.5ms	MC4221AV	$1469
3000MB	11ms	MC1936AV	$1699
4294MB	8ms	MC3243AV	$2359
9100MB	12ms	MC1991AV	$3499

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IDE			
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420MB	14ms	ST3491A	$199
545MB	12ms	ST5660A	$259
722MB	12ms	ST3780A	$325
1083MB	12ms	ST31220A	$485
SCSI (WIDE SCSI also available)			
1052MB	9ms	ST31200N	$569
1700MB	9ms	ST11900N	$1019
2145MB	8ms	ST12550N	$1199
2148MB	9ms	ST12400N	$1029
4290MB	9ms	ST15230N	$1979
4290MB	8ms	ST15150N	$2239
9080MB	11ms	ST410800N	$3339

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365MB	11ms	LT340A	$188
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731MB	11ms	LT730A	$295
SCSI			
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1080MB	10ms	IMP1080	$549
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4280MB	8.6ms	GP4280S	$2399

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527MB	12ms	70G8486	$259
728MB	12ms	70G8511	$329
1052MB	8.6ms	70G8512	$579
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270MB	SQ3270S	$369	$519	$489
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270MB	SQ3270A	$339	$439	$529

Cartridges Qty 2-4 / 5-9 / 10+ or with drive
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WIDE SCSI, Macintosh Drives, Power Mac Drives, Hard Disk Cards, PCMCIA Drives, 2 1/2" Drives, Floppy Drives, IBM PS/1, PS/2, and Tandy Drives.

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Plextor	PX43CH	4X	150ms	$449
NEC	CDR510	3X	195ms	$279
Toshiba	XM3401	2X	200ms	$255
Sanyo	SH93R	2X	280ms	$149
IDE (ATAPI)				
Mitsumi	CRMCFX400	4X	230ms	$249

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XM3401	$425	$549	$425	$479
CDR510	$449	$569	$449	$499
XM3501	$569	$689	$569	$629
PX43CH	$599	$729	$599	$669

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A1542CBASIC 16Bit SCSI	$225	$215
A2742 EISA SCSI	$379	$369
A2842 VESA SCSI	$259	$249
A2940Kit PCI SCSI	$299	$289
Future Domain 1680 16Bit SCSI	$134	$119
QLOGIC PCI SCSI & WIDE	$325	$315
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DC690C 32Bit PCI IDE	$149	$139
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525MB	Conner	C2525	$479	$639
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2Gig	Conner	4320	$749	$849
2Gig	HP	35470	$829	$929
NEW DRIVES Back-up speed 54MB/min				
2-4Gig	Conner	3200	$589	$699
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4-8Gig	HP	35480	$929	$1039
4-16Gig	Sony	SDT5000	$899	$1019
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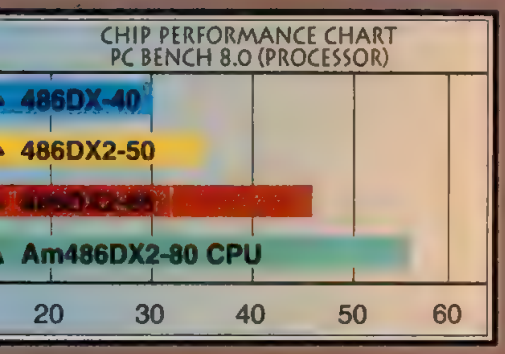

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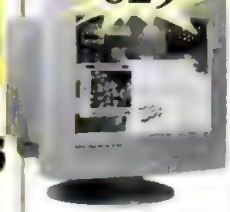

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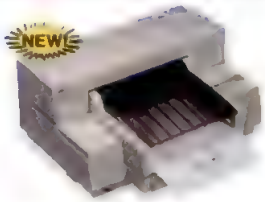

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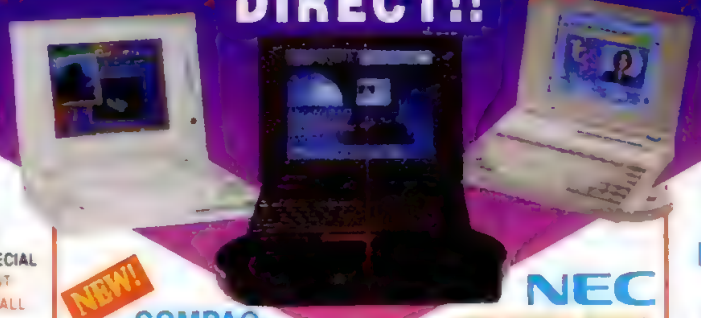

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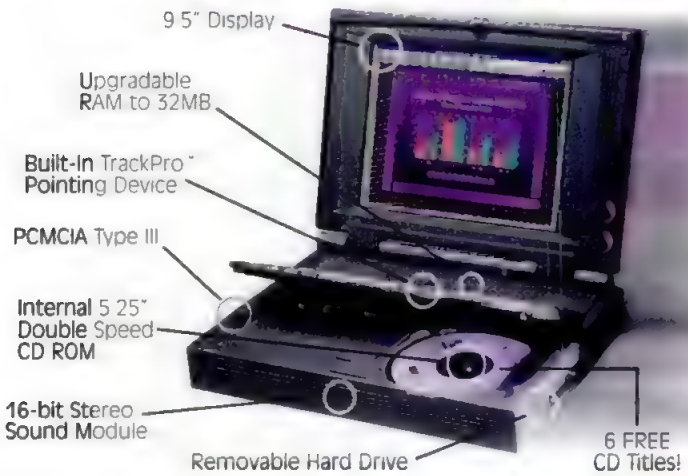

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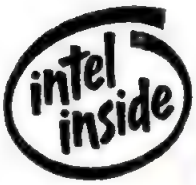

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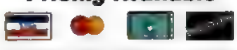

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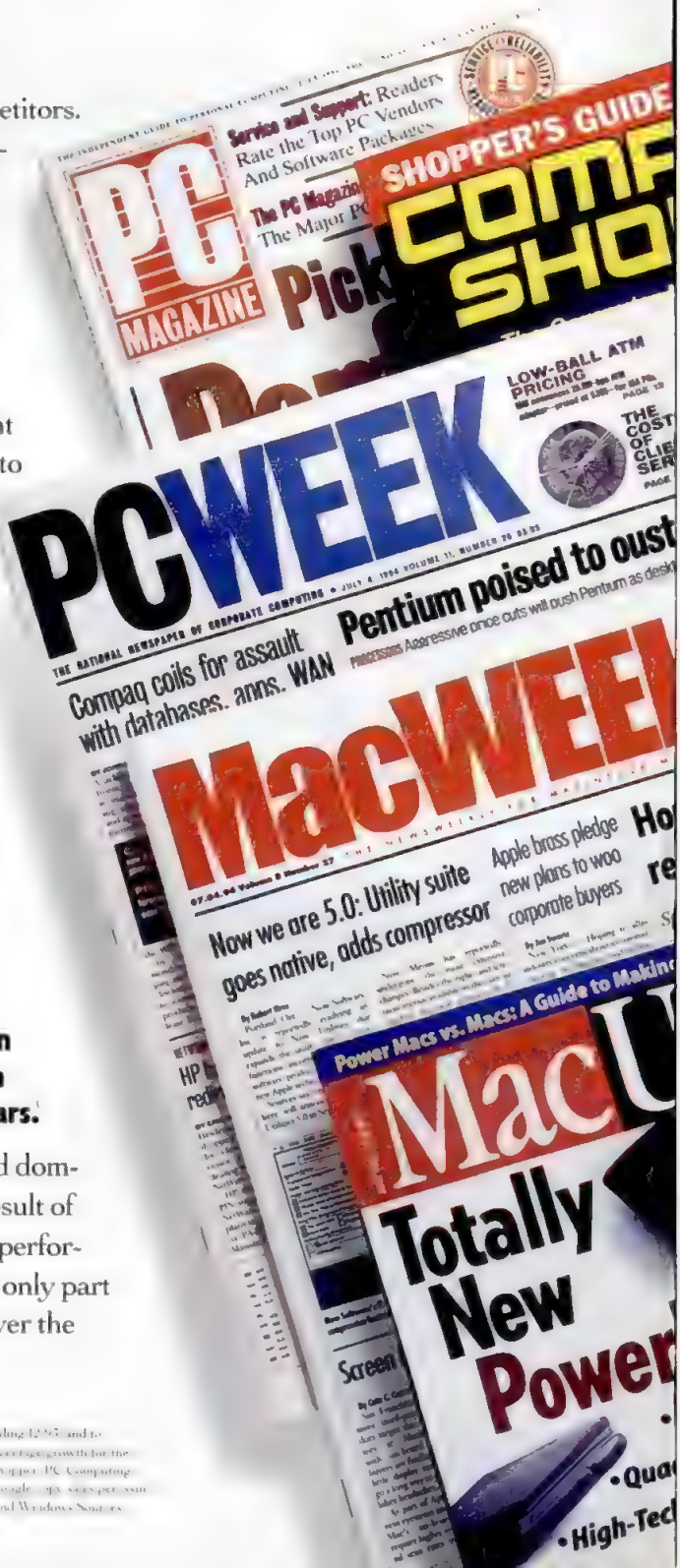

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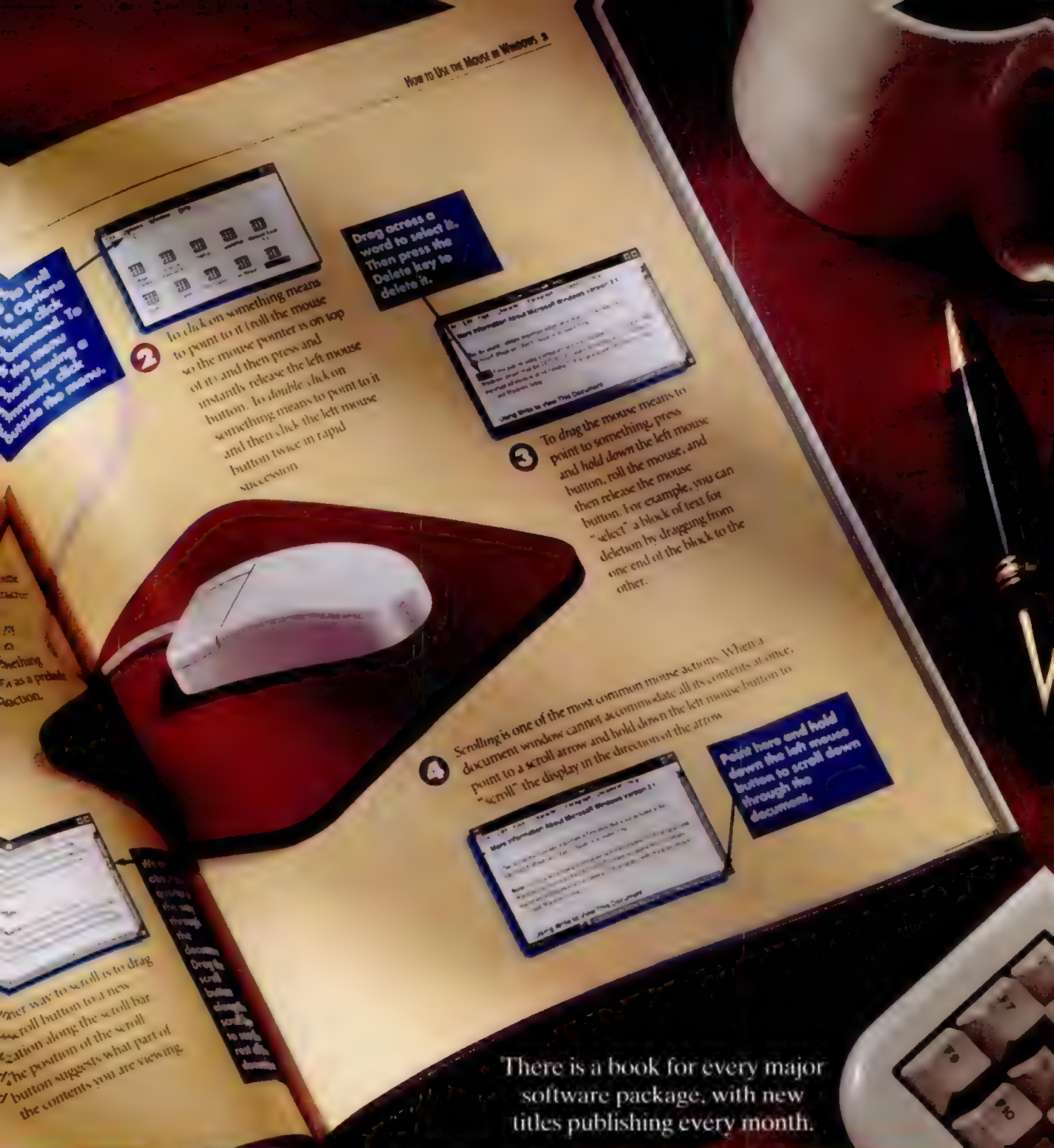

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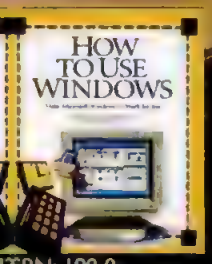

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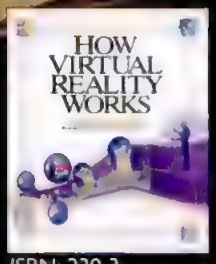

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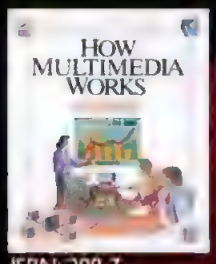

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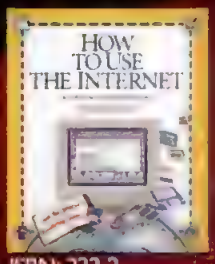

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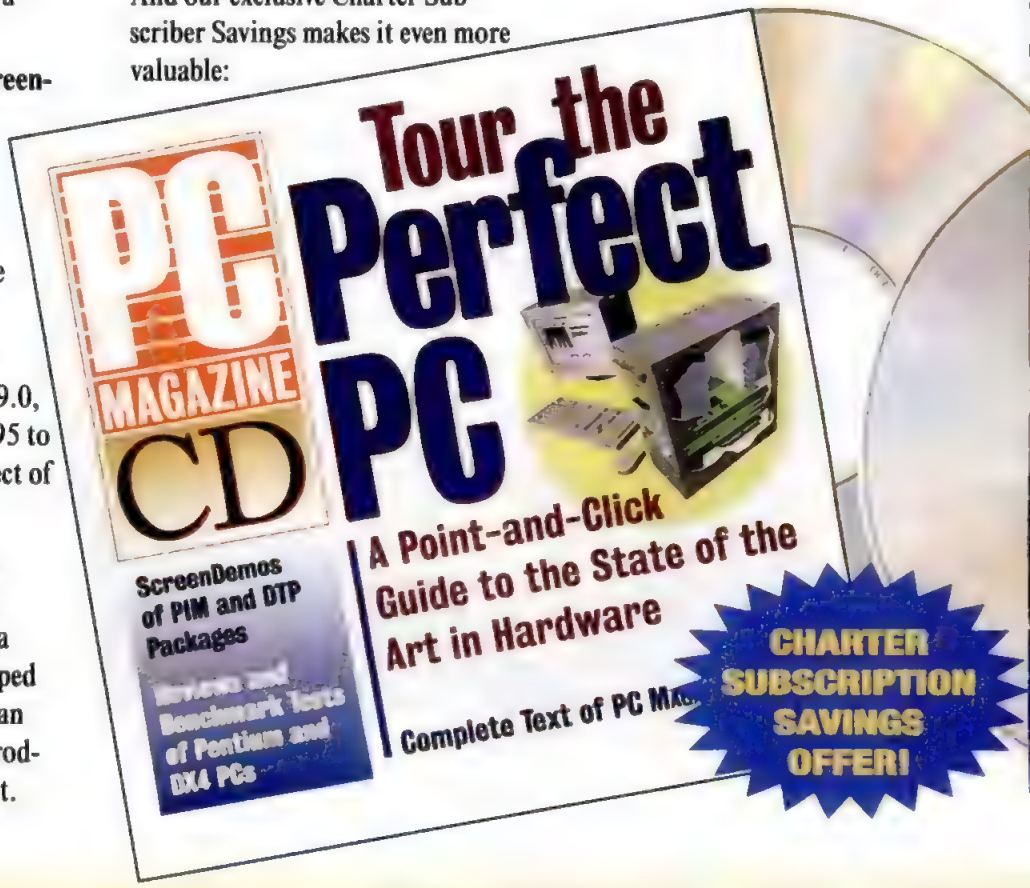

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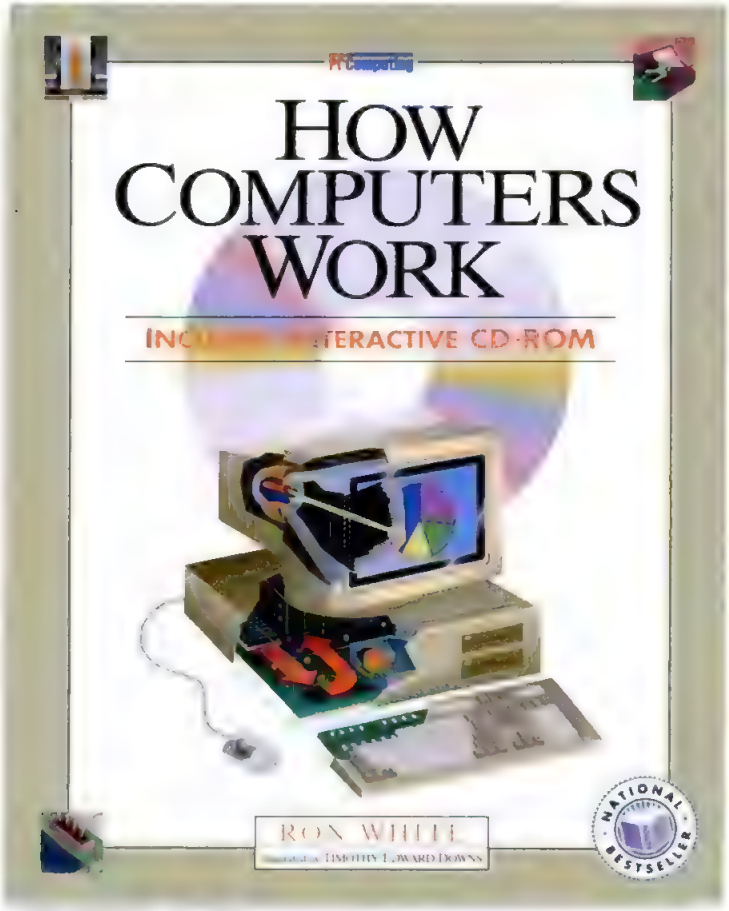

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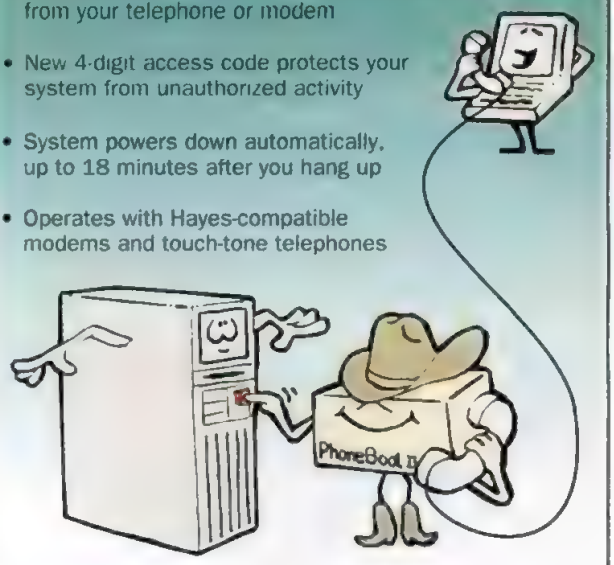

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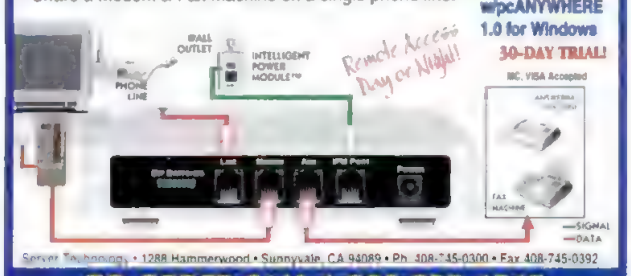

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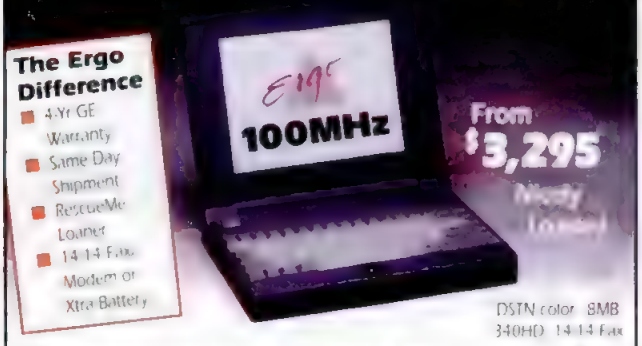

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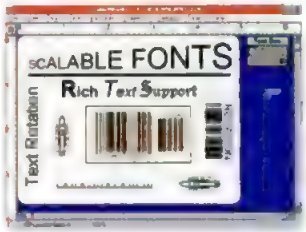

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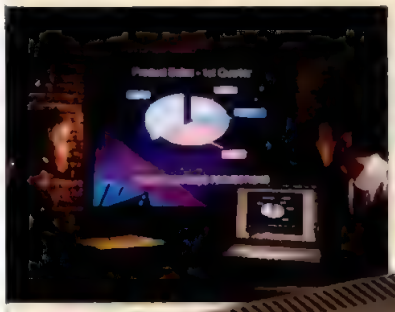

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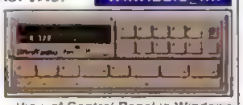

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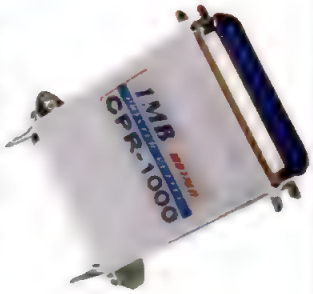

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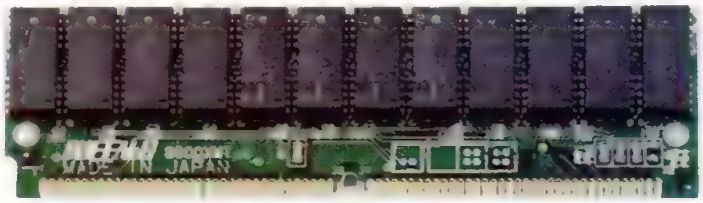

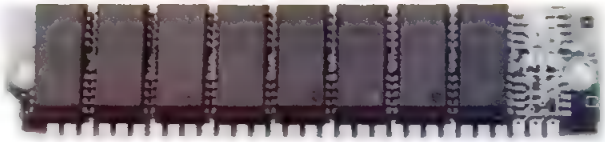

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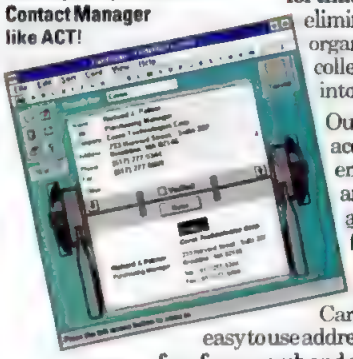

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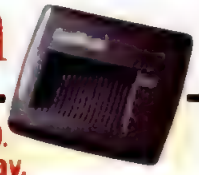

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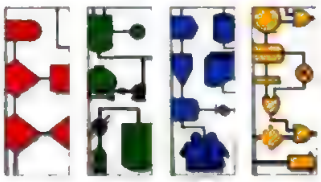

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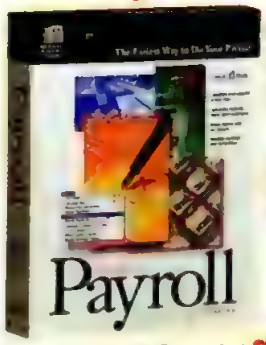

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ST-[illegible]A	540MB	12MS	IDE 3.5"	$316
ST-[illegible]	52[illegible]MB	15MS	SCSI 3.5"	$478
ST-[illegible]	1[illegible]MB	9MS	SCSI	$668
ST-[illegible]N	2[illegible]MB	9MS	SCSI	$1[illegible]

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FA[illegible]A	340MB	12MS	IDE	$ 1[illegible]
FA[illegible]A	420MB	12MS	IDE	$229
FA540A	540MB	12MS	IDE	$258
CFA[illegible]	850MB	12MS	IDE	$498
CFA1000A/B	1000MB	10MS	IDE/SCSI	$800

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M[illegible]	2[illegible]MB	8MS	5.5"	$2[illegible]
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	8MB	PA8315U	$358
T1200 XE	2MB	PA3308U	$90
T1600	2MB	PA8303U	$90
T2000 SXE/T2000SX/T1800 T1850, C	2MB	PA3000U	$73
	4MB	PA3001U	$188
	8MB	PA3002U	$358
T3100	2MB	PA7135E	$130
T3100 E	2MB	PA8341U	$108
T3100 SX	2MB	PA8308U	$100
	4MB	PA8310U	$188
T3200 SX	2MB	PA8307U	$110
	4MB	PA8309U	$190
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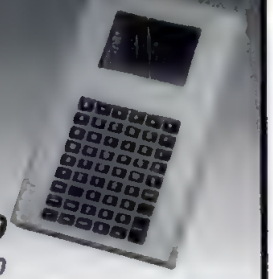

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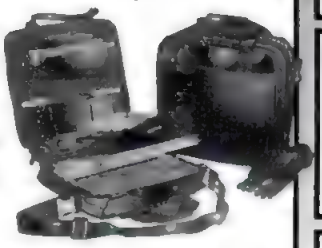

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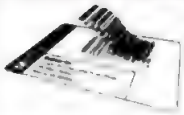

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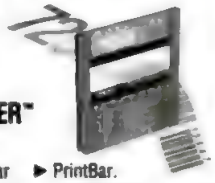

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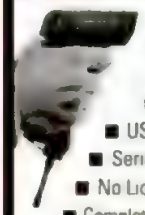

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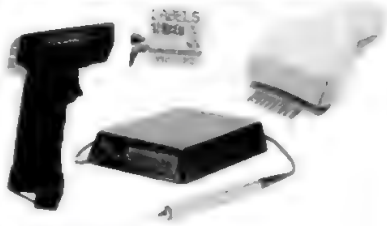

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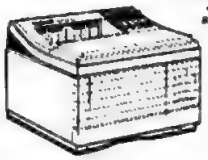

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PC MAGAZINE

Coming Up

The Best Products of 1994

As the new year begins, we take stock of the very best from the old. Here are the personal computer products of 1994 that really made the grade: the ones that made our work easier, enlivened our play time, and opened up new ways of doing things we hadn't known before. More than just meeting our needs, these gems got us excited about computing all over again.

Service & Reliability

As the computer market continues to expand at a dizzying pace, a vendor's ability to support the products it sells has become a major factor in many buyers' purchasing decisions. In our latest Service & Reliability Survey, we tell you what *PC Magazine* readers think of their PCs, monitors, and printers—and how satisfied they are with the service they're getting.

Personal Finance Software

If you've come to rely on ATMs and automated banking services to manage your personal finances, get ready: The way you balance your checkbook, track your bank account, and pay bills is taking a giant leap into the future. With software vendors and banks joining forces to make banking at home a more convenient, less time-consuming option, you may soon be able to make your mortgage payments, pay off credit cards, or follow the stock market—all from your PC. While this may not happen tomorrow, it's probably not far off. We look at five personal finance programs and seven on-line investment packages that promise to help you get a handle on the bottom line.

Wireless Local Area Networks

If your network users are looking for an easy way to keep their notebooks connected to the LAN as they roam around the office, you finally have some viable solutions to consider. Wireless LAN products—adapters and access points—have come a long way in a year. We review the first crop of these affordable products, which make for a good adjunct to the wired LAN.

Free Utility

Where confidentiality is important, a shredding machine is an essential piece of office equipment. But more and more often now, sensitive data can be found on-disk, and simply deleting such files does not ensure that they are unrecoverable. What's needed is a way to shred disk files as thoroughly as a paper shredder destroys documents. That's just what SHRED, our next utility, does.

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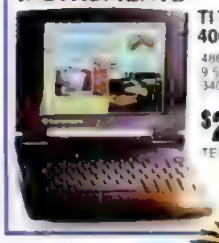

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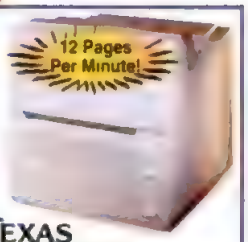

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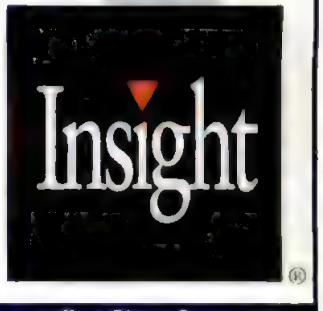

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After Hours

EDITOR'S RATINGS: ★ Poor ★★ Fair ★★★ Good ★★★★ Excellent

DOS Windows CD-ROM Resource-Intensive Adult Content Kids (Ages) Price

(Joy)Stick It to Your PC: Alternate Input Devices

Mice, trackballs, and touch-sensitive screens may work just fine with your word processor or spreadsheet, but they're not much use with your flight simulator or favorite adventure game. If you don't believe me, try using your mouse to outmaneuver that rebel aircraft; it won't be pretty. Instead, try using a joystick. The PC joystick market has virtually exploded with futuristic, functional, and complex input devices to satisfy everyone from the occasional gamer to Top Gun wanna-bes.

F-16 FLCS Flight Control System

ThrustMaster Inc.; 503-639-3200.

Circle 474 on reader service card

★★★ $199.95

ThrustMaster's original joystick, the FCS (Flight Control System), was modeled after the flightstick found in the workhorse of the Korean and Vietnam Wars—the F-4 Phantom fighter jet. But with new combat simulations come new planes and new joysticks. One of these new joysticks, the F-16 FLCS Flight Control System, caters to combat-jet-simulation fans who flock to the temple of F-16 simulation: Falcon 3.0.

The F-16 FLCS replicates the F-16C Falcon's flightstick.

As its name suggests, the F-16 FLCS is modeled after the flightstick in the F-16C Falcon, one of the most maneuverable and deadly fighters in the world. The F-16 FLCS, which plugs into the keyboard and joystick ports, features four buttons, a dual-stage trigger, and four eight-way toggle hat buttons. All of these controls are in an ergonomic design that's been tested by combat veterans—the real ones, not just VGA jockeys.

Unlike the original FCS, this joystick does not require direct game support or TSRs, making it far more flexible. Each button on the F-16 FLCS is user-programmable, so you can set buttons either to emulate keystrokes or to function as standard joystick buttons. The customization process is somewhat complex but can be avoided by using the included preconfigured joystick settings; they cover virtually all simulation software and other popular games (such as DOOM).

The multitude of toggle switches and buttons might be intimidating at first, but it pays to persevere.

PROBLEM SOLVER

Users of the Creative Labs Sound Blaster 16 SCSI-2 beware: This sound board's joystick port does not provide enough juice to power the Phoenix or the F-16 FLCS. Instead, plug your game device into a dedicated joystick port card or your PC's own joystick port.

Flightstick Pro

CH Products; 800-624-5804, 619-598-2524.

Circle 475 on reader service card

★★ $99.95

CH Products has been in the joystick business for years—as far back as the old Apple II days, at least. Those years of experience produced the original Flightstick—a solid, no-nonsense, pistol-grip joystick that many virtual pilots found the most durable for any simulation. The Flightstick Pro is a sturdy if conservative improvement on the original.

The Flightstick Pro is a bulky and comfortable joystick.

There are three buttons on the top of the stick, a firing button in the trigger position, a throttle, and a four-way toggle hat switch (which is useful for frequent commands such as weapons selection). The joystick is solid and bulky and should feel com-

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fortable in the hands of any would-be Top Gun.

The Flightstick Pro is not programmable, but many simulations—such as Origin Systems' Strike Commander, LucasArts Entertainment Co.'s TIE Fighter, and Microsoft Flight Simulator 5.0—support its extra features. In early 1995, look for CH Products to introduce the Pro-Throttle, an accessory that will allow users to program the Flightstick Pro.

For now, if you want a durable, well-supported, and simple-to-use joystick, the Flightstick Pro is a solid choice.

Little Monster at School

CD-ROM PICK HIT

Load up this latest Living Book and your kids will never be frightened by monsters again.

In this interactive animated storybook (based on Mercer Mayer's best-selling book) kids follow Little Monster from home to school, where he learns about ABCs, numbers, science, and more. Through the day, kids get to meet his whole monster clan and help take care of his funny little monster pet, Zipperump-a-zoo.

As in all the CD-ROMs in this series, the story unfolds in either English or Spanish. A simple mouse click launches witty animations, including Baby Monster flinging oatmeal at her siblings. Kids can have the story read to them by the computer or explore at their own pace in a fun-filled world of sight, sound, and good-natured monsters.—*Gayle C. Ehrenman*

Living Books; 800-521-6263.

Circle 481 on reader service card

★★★★ $49.00

Logitech Wingman

Logitech Inc.; 800-732-2990, 510-795-8500.

Circle 476 on reader service card

★★★ $39.95

Logitech has made a name for itself by designing ergonomic, stylish mice and other input devices. It was only a matter of time before the company turned its attention to joysticks.

The new Wingman combines Logitech's sound ergonomic principles with a design that manages to look futuristic and organic at the same time.

The Wingman combines no-frills style with futuristic design.

The Wingman is a basic, no-frills stick that sports two buttons along with the ubiquitous pistol grip. The Wingman also has a dial throttle control on the base, and as with all joysticks that provide throttle controls, you'll need a game port that supports two joysticks to take advantage of this feature.

The Wingman has been sculpted to fit the human hand, and we found it to be the most comfortable of all the joysticks tested in this roundup. Its heavy base, comfortable rubber buttons, and 7-foot cable make this the most practical and usable of the nonprogrammable joysticks we tested. Furthermore, the base is heavier, and it proves to be the most stable of the one-handed joysticks.

Although it lacks the gritty realism of military-design joysticks, the Wingman is a perfect example of what experience and careful design can produce.

Those who want more buttons (but still no programmability) should be on the lookout for the forthcoming Wingman Extreme, which adds a four-way hat switch as well as four buttons to the sturdy Wingman design.

Phoenix Flight and Weapons Control System

Advanced Gravis Computer Technology Ltd.; 800-663-8558, 604-431-5020.

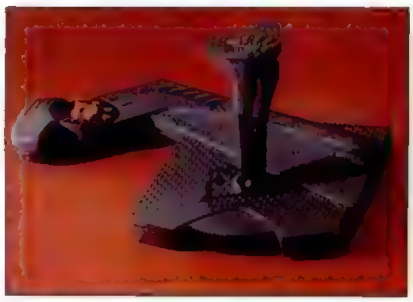
Circle 477 on reader service card

★★★★ $149.95

If you're tired of needing both a joystick and a keyboard to play your favorite flight simulator, take a look at the Phoenix Flight and Weapons Control System. This futuristic console integrates analog and digital throttle and rudder control and 24 keys that can be programmed for up to 46 different functions (one button is reserved as a "shift" key). The game system plugs into your joystick and keyboard ports (your keyboard plugs into the Phoenix) so that the joystick can emulate whatever keystrokes you need.

Customizing the joystick is easy, thanks to the Phoenix Control Console—a DOS-based graphical interface that allows you to define and program button functions. To help you keep track of the all the programmed keys, the support software allows you to print a diagram of the joystick console, complete with all the settings. The package also includes a library of preconfigured flight control settings for many popular games. Once programmed, the Phoenix stores your preferences in nonvolatile RAM; no TSRs or other memory-gobbling drivers are required.

Unfortunately, there's no way around the fact that the Phoenix takes up lots of desk space—almost as much as a keyboard. Despite this drawback and the high price, the Phoenix is the most sophisticated and flexible multipurpose joystick money can buy.



This high-performance stick will support all games that offer Thrustmaster FCS presets.

—*Bernard H. Yee*

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Gadgets

The Next All-in-One Alternate Input Device

Aeroduet

Creative Labs; 408-428-6600.

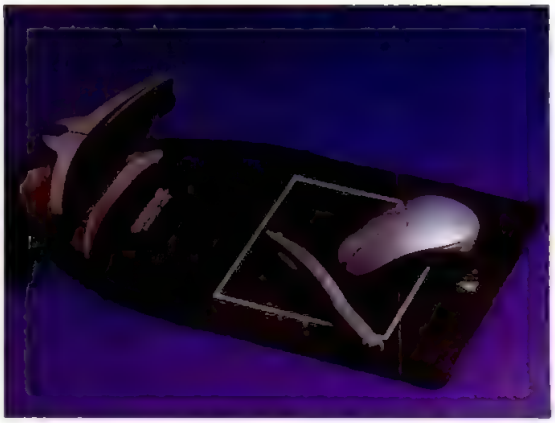
Circle 478 on reader service card

★★★ $199.95

It isn't a joystick, but the new Aeroduet from Creative Labs—which includes the AeroMouse and the AeroPen—has great potential as a game input device. It also provides other more mundane features like pen computing and standard mouse functions.

With this package, you get not only the AeroMouse (a two-button cordless mouse that combines the best features of a wireless mouse with 3-D capabilities) but the AeroPen (a wireless digital pen that can also be used as a low-cost digitizer), a 3-D receiver, and a mousepad.

To use these devices, simply place the receiver on your desk and plug it into your PC. The receiver processes the infrared signals from the pen and mouse, calculating the *x*-, *y*-, and *z*-axis locations. Both the pen and the mouse need to be used in front of the receiver to be effective; the AeroMouse can be raised about 8 inches off the desk before it begins to lose contact with the receiver.



The Aeroduet combines an infrared receiver, a wireless pen, and a 3-D mouse in one convenient package.

Both devices are also sold separately and require batteries.

The pen has a button on its side and a stylus point, but the point is not pressure-sensitive, so it's less than ideal for use with natural-media painting software. Still, it is useful for tracing and pen computing.

The AeroMouse offers the 3-D capabilities of Logitech's CyberMan; the only things the Aeroduet lacks are pitch, yaw, and roll controls. Even so, only a handful of games directly support the AeroMouse at this time.

The Aeroduet ships with a variety of software, including Fractal Design Dabbler and the quasi-virtual-reality game Spectre VR. The included software allows the user to customize the virtual work area and switch from mouse to tablet mode.

It's not tailored specifically for games, but the Aeroduet is an interesting development in the evolution of the input device, and one that holds great promise for gamers.—*BHY*

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Strategy

Serf's Up!

Serf City

Strategic Simulations Inc.; 408-737-6800

Circle 480 on reader service card

★★★ CD $60.00

Think of Serf City as a medieval SimCity. Starting out with a castle and some unoccupied, unpolluted land (a clear tip-off that this is a role-playing fantasy), you get to build 24 different structures to house and employ 25 different kinds of serfs.

It's a complex little serf society, which you've got to promulgate and defend. Geologists prospect for valuable ores. Forest rangers plant trees; lumberjacks cut them down. Farmers harvest wheat, which is taken to millers who manufacture flour and then to bakers who bake bread. Bread, pigs, and fish supply miners, while shipbuilders and toolmakers give transporters the means to move goods over land and sea.

Think of Serf City as a medieval SimCity, where you are the king of the simulated castle.

Five levels of serf knights defend and extend your borders. You can play one to three Serf City opponents drawn from ten computerized personalities with differing development and conquest strategies. Opponents can be modified for many factors, including land resources and production efficiency.

If fighting isn't your style, however, try playing this game in solo mode—without enemies. There's plenty of room for growth on any of the 270 billion possible worlds that Serf City can create. In fact, with 16MB of RAM and a Size 8 World, you can direct the activities and destinations of up to 64,000 serfs.

If variety, world modeling, stimulating opponents, and excellent Super VGA graphics were all that defined a good strategy release, Serf City would have it made. But when it comes to ease of use, Serf City is a bit of a wash-out. To scroll, you have to click and drag your cursor across the edge of the screen—but this works only about half the time. Button images are poorly chosen and have no labels. You can get a breakdown of your current serf population by type, but you select the types from a screen of 25 serf heads that look nearly identical. Still, the documentation is excellent. For micromanaging a civilization or fighting off pirate serfs, Serf City delivers the goods. —*Barry Brenesal*

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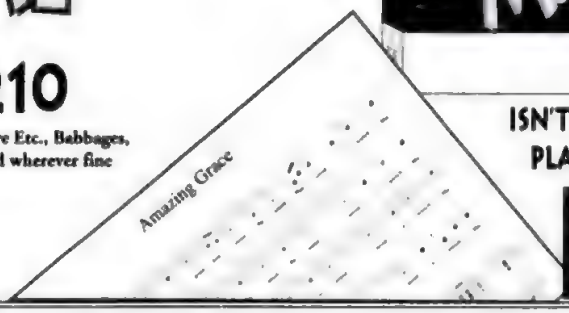

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Action

Carnage With a Cyberpunk Storyline

System Shock

Origin Systems; 512-335-5200.

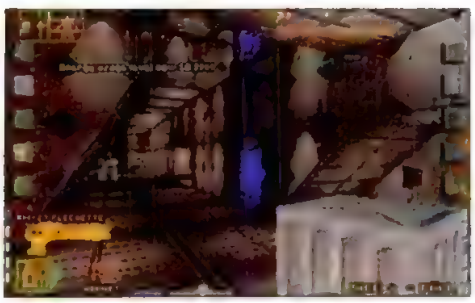
Circle 479 on reader service card

★★★★

We live in the post-DOOM era. Few applications have captured the imaginations of PC gamers as well as this 3-D first-person-perspective gorefest from id Software. But now there's a challenger on the horizon: System Shock. This cyberpunk action thriller from Origin Systems (better known for its Ultima role-playing games and Wing Commander simulations) manages to outdo DOOM.

Like DOOM, System Shock is full of violence. But unlike DOOM, this action adventure is a full 3-D, vertigo-inducing game: You can look up and down, jump, crouch, crawl, and even peer around corners—all while enjoying a real storyline.

Fans of William Gibson's novel *Neuromancer* should feel right at home on the *Citadel*, the space station where System Shock takes place. Our hero, a hacker, wakes up from a healing coma with a super-high-tech neural implant; it's his reward for freeing the station's artificial intelligence (AI) system from its "ethical constraints" at the behest of a dirty corporate toad. Unfortunately for everyone aboard the space station, the AI system has taken a dislike to humans and has killed or mutated just about everyone but the hero. The hero must put an end to the carnage and stop the AI system.



Jack into cyberspace and kill anything that moves in System Shock.

The setting is moody and atmospheric. All the cyberpunk pastimes are here: "jacking" into cyberspace, retrieving data, finding new software tools and weapons. And there are even puzzles to solve. With a fabulous sound track, digitized effects, and support for VR helmets (in the enhanced CD-ROM version), System Shock is the most addictive action/role-playing hybrid to arrive in years.—*BHY*

QUICK CLIPS

Recommended · It's Your Call · Not Recommended

Glider 4.0 for Windows

Flying doesn't get any more low-tech than with this gentle flight of fancy in which you pilot a paper glider. Catch a draft and start soaring! *$49.95; Casady & Greene; 800-359-4920.*

Comedy Central Sports Shorts

These choppy sports-theme comedy video clips prove that PCs and video are a match made anyplace but heaven. The humor is better than open-mike night in a local nightclub, but the ambience leaves something to be desired. *$19.95; Time Warner Interactive; 800-482-3766.*

Word Power For Kids

This CD-ROM is an ambitious attempt to build kids' language skills, but the activities need jazzing up if Junior's going to play long enough to learn the meaning of the word *vocabulary*. *$64.95; Smartek Software; 800-858-9673.*

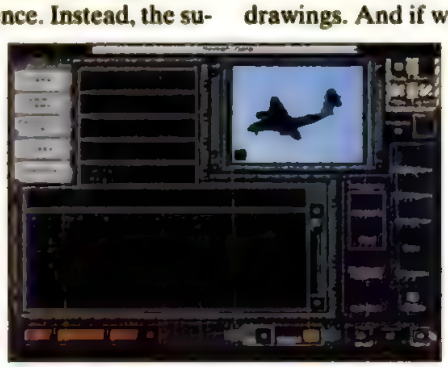
Indianapolis Motor Speedway Expansion Pack

Climb back in the cockpits of your cars, racing fans. This add-on to Papyrus's popular IndyCar Racing simulation gives you a new track to tool around, as well as enough game play enhancements to carry you to the checkered flag. *$39.99; Papyrus Publishing Inc.; 800-874-4607.*

SPOTLIGHT ON HISTORY

Warplanes

You might think that Warplanes: Modern Fighting Aircraft, a CD-ROM database about military aircraft, would appeal to only a limited audience. Instead, the superb use of video and animation makes learning the role of aircraft in modern warfare an interactive experience that will appeal to more than just aviation buffs.



You don't simply view major aircraft in Warplanes, though it contains more than 1,000 full-screen photographs. You can also walk around more than 25 3-D models reconstructed from the original engineering drawings. And if walking tires you out, just try piloting one of three planes in thoroughly accurate if visually unimpressive flight simulations.

The core of Warplanes is its database of in-depth technical material on 500 aircraft and 200 weapons systems for post-1975 aircraft. The weight of detail is staggering: photos and video clips, records of service, and information on costs, armaments, crew, dimensions, and performance. Multiple-level searches, a quick-find feature, and hypertext links make sorting through all this material easy.

Warplanes: Modern Fighting Aircraft is the first in a series of six CD-ROMs planned to cover all military aviation. If this first installment is any indication, the series will be flying high.—*BB*

Maris Multimedia; 800-336-0185, 510-652-6430.

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★★★★

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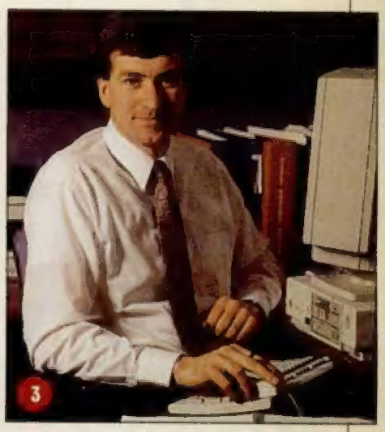
Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Don Willmott

What's Wrong with These Pictures?

It's time for our second annual test of your computer knowledge (and your eyesight). Find the stupid mistake in each picture, and if you need a little help, consult the hints below.



HINTS

1. What is this? Telepathic Prodigy?
2. Down in front!!!
3. Uh, how about a mouse pad for Christmas?
4. Junior's doing well, all things considered.
5. This guy must be Junior's dad.
6. Maybe the computer's inside the plant.
7. That's no way to feed a laser printer.

If your entry is used, we'll send you $50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802. Winners this issue: Brian Darvell, J. Calvin Davidson, Gil Jeffer, Daniel Kametani, Michelle Morehouse, Ben Myers, and Donna Marie Vincent.

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